

R E P O R T  
ON THE  
SCIENTIFIC RESULTS  
OF THE  
VOYAGE OF H.M.S. CHALLENGER  
DURING THE YEARS 1873-76

UNDER THE COMMAND OF  
CAPTAIN GEORGE S. NARES, R.N., F.R.S.  
AND  
CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF  
THE LATE  
Sir C. WYVILLE THOMSON, Knt., F.R.S., &c.  
REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH  
DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD  
AND NOW OF  
JOHN MURRAY, F.R.S.E.  
ONE OF THE NATURALISTS OF THE EXPEDITION

ZOOLOGY—VOL. VII.  
PART XIX.—REPORT ON THE PELAGIC HEMIPTERA.

Published by Order of Her Majesty's Government

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE  
AND SOLD BY  
LONDON:—LONGMANS & CO.; JOHN MURRAY; MACMILLAN & CO.; SIMPKIN, MARSHALL & CO.  
TRÜBNER & CO.; E. STANFORD; J. D. POTTER; AND KEGAN PAUL, TRENCH, & CO.  
EDINBURGH:—ADAM & CHARLES BLACK AND DOUGLAS & FOULIS.  
DUBLIN:—A. THOM & CO. AND HODGES, FIGGIS, & CO.

1883

*Price Three Shillings and Sixpence.*

PRINTED BY NEILL AND COMPANY, EDINBURGH,  
FOR HER MAJESTY'S STATIONERY OFFICE.



## N O T E.

THE special work of the Challenger Expedition was the examination of the Physical and Biological conditions of the great Ocean Basins, and the detailed Official Reports on the Scientific Results of the Expedition will—with few exceptions—be limited to those departments of research referring more or less directly to the Ocean. The large collections of Insects, Land Shells, Spiders, Amphibians, Reptiles, and Mammals, made by the Naturalists on land at the various ports and islands touched at throughout the cruise, being regarded as “Incidental Collections,” have been deposited in the British Museum, to be examined by the officers in charge of the national collections. These “Incidental Collections” will be referred to in the Volumes devoted to the Narrative of the cruise, but it is not proposed to publish any detailed Reports concerning them.

The only Insects having a truly oceanic habitat belong to the genus *Halobates* and one or two allied genera, and consequently this Memoir, by Dr. F. Buchanan White, on those Pelagic Hemiptera, is the only one relating to the class Insecta which will appear in the series of Challenger Reports.

The Memoir was received on the 6th February 1883, and forms Part. XIX. of the Zoological Series of Reports on the Scientific Results of the Expedition.

JOHN MURRAY.

CHALLENGER OFFICE,  
EDINBURGH, 20th July 1883.



8 QL  
521  
W58  
1883  
Ent

THE  
VOYAGE OF H.M.S. CHALLENGER.

---

ZOOLOGY.

---

REPORT on the PELAGIC HEMIPTERA procured during the Voyage of H.M.S.  
Challenger, in the years 1873-1876. By F.<sup>Francis</sup> BUCHANAN WHITE, M.D.,  
F.L.S.

I. HISTORY AND BIBLIOGRAPHY.

THE only Pelagic Hemiptera, and indeed the only truly pelagic insects, belong to the genus *Halobates* and one or two allied genera. *Halobates* was founded in 1822 by Professor J. Friedrich Eschscholtz, of the University of Dorpat, for the reception of three species taken during von Kotzebue's voyage round the world in the ship "Rurick." Since that time a few other species have been described, but specimens are still rare in collections, and consequently little has been added to our knowledge of the genus.

A special interest is attached to these animals, as being the only pelagic representatives of their class. It is true that a few other insects are marine,<sup>1</sup> but they are all found in close proximity to the shore, whereas the species of *Halobates* usually, and in some cases only, occur at a considerable distance from any land. Moreover, their structure would seem to indicate that they are archaic forms of very great antiquity, and hence all that can be learned with regard to them is of very great importance.

Abundantly as they seem to be distributed in the tropical seas, specimens are very rare in collections, and, when named at all, are in most cases wrongly determined.

For these reasons it has been deemed advisable to attempt a monograph of the genus, though it is probable that many species yet remain to be discovered by those who have the opportunity and the will to turn their attention in this direction.

The literature of the genus is not extensive, but, as it is much scattered, it has been

<sup>1</sup> Amongst these may be noticed species of *Aëpus*, *Hesperophilus*, *Micralymna*, &c., belonging to the Coleoptera; *Aëpophilus* amongst the Hemiptera; two Caddis-flies (*Philarisus plebejus* and *Molanna*, sp.) amongst the Neuroptera; and a few Diptera (such as *Chironomus oceanicus*); which either in the perfect or in the larval condition habitually live below high-water mark. In addition to these some other species are to be found occasionally in salt or brackish water.

thought desirable to reproduce in this monograph the more important parts of it, in order that those who wish to study the species in their native localities may have every facility for so doing. Moreover, since the types of several of the described species have apparently disappeared, it is desirable that the student should have, in an easily accessible form, the exact words of those who have written on the subject.

We will therefore begin by reproducing, in chronological order, the more important writings on the subject.

#### I.—J. FRIEDRICH ESCHSCHOLTZ.

Entomographien. Erste Lieferung, 1822, p. 106, Taf. ii. figs. 3, 4, and 5. Also *Naturwissenschaftlich. Abhandl. aus Dorpat*, 1823, p. 163, Taf. ii. figs. 3, 4, and 5.

##### “78a. *Halobates*.

“Diese neue Wanzen-gattung aus der Familie Cimicidae Ploteres Latr. ist mit *Velia* und *Gerris* Latr. sehr nahe verwandt und hat sich den Ocean zum Jagdrevier erwählt; man kann sie so bezeichnen:

“Antennæ articulo basali elongato. Rostrum breve, conicum, vagina triarticulata. Collare annuliforme. Thorax maximus, apterus. Tarsi antici triarticulati: articulo secundo ultra tertium unguiculatum protenso; posteriores biarticulati, exunguiculati.

“Der Kopf ist vorgestreckt, breit. Augen gross; Nebenaugen fehlen. Kopfschild vorgestreckt, gewölbt. Oberlippe eiförmig, gekrümmt, spitz. Rüsselscheide dreigliedrig; das erste Glied kurz breit, das zweite das längste, und das Endglied gekrümmt und spitz. Borsten drei. Fühler vor den Augen auf einer starken Erhöhung des Kopfs sitzend, viergliedrig, fadenförmig; das erste Glied das längste.

“Halsschild sehr kurz, ringförmig. Mittelleib sehr gross, ungeflügelt. Hinterleib sehr kurz. Afterdecke des Männchens spitz; des Weibchens gross breit rautenförmig. Vorderbeine kurz mit dicken Schenkeln; Schienen von gleicher Länge mit letztem, walzenförmig, am Ende mit einem nach innen vorspringenden hakenförmigen Fortsatze, der in eine Furche zwischen Beinwurzel und Schenkel passt; die Füße dieser Beine scheinen, von oben betrachtet, nur aus zwei ziemlich langen dicken Gliedern zu bestehen; aber an der Unterseite des zweiten längern Gliedes bemerkt man noch ein drittes sehr kurzes abstehendes Glied, das am Ende mit zwei gekrümmten Haken bewaffnet ist.

“Mittlere Beine zwei bis dreimal länger als der Körper, dem Mittelleibe an seinem untern und hintersten Theile angefügt; Hüftglied sehr dick, kurz; Gelenkkopf lang und mit seinem zugespitzten Ende dem Schenkel von der Seite angeheftet; Schenkel sehr lang, walzenförmig; Schienen dünner und um mehr als die Hälfte kürzen. Füße zweigliedrig; das erste wenig kürzer, als die Schienen und gewöhnlich gekrümmt; das Endglied kurz, fein und am Ende mit einigen langen Haaren bewaffnet.

“Hinterbeine über den mittlern eingefügte, um ein Drittheil kürzer als diese, mit längern Hüftgliedern, feinern Schienen und Fussgliedern, von welchen letztern das erste Glied kaum länger als das zweite zugespitzte und langebehaart ist.

“Der Körper ist mit sehr feinen silberfarbenen Schuppen bedeckt, die Beine gewöhnlich schwarz. Die Thierchen springen auf der Oberfläche des Meeres herum, und kommen nur in den Tropen oder in der Nähe derselben vor. Drei mir bekannt gewordene Arten unterscheiden sich folgendermassen :

“78. b. *Halobates micans* (Taf. ii. fig. 3).

“H. corpore conico, subtus argenteo, supra cinereo aëneo micante ; oculis atris.

“Im südlichen stillen Meere und im südlichen atlantischen Meere.

“Länge  $1\frac{1}{2}$  Linien, grösste Breite eine Linie. Kopf breiter wie lang, gewölbt, der grösste Theil grau, der vordere Rand silberweiss. Augen zur Seite des Kopfs hervorstehend, gross, schwarz. Fühler etwas länger als der halbe Körper, am Ende etwas verdickt, Glieder walzenförmig, schwarz, matt; das erste so lang, als die übrigen zusammengekommen, die beiden folgenden gleich lang, das letzte etwas länger als das vorhergehende.

“Halsschild breiter als der Kopf (ohne Augen), mehr als dreimal breiter als lang, vorn stark und hinten kaum merklich ausgeschnitten, Seiten gerade, hinabhängend, Oberfläche kaum gewölbt mit zwei länglichen Eindrücken am Vorderrande; grau etwas glänzend. Mittelleib vorn etwas breiter, als das Halsschild, bis hinter der Mitte ziemlich stark erweitert, dann gleich breit, fast zweimal so lang als Kopf und Halsschild zusammen, vorn gewölbt, hinten ausgehöhlt abschüssig, mit einer kleinen etwas unbestimmten mittlern Längskante am letztern Orte; schwärzlich grau mit Messingglanz. Hinterleibsringe weissgrau. Unterseite des ganzen Körpers silberweiss. Beine schwarz, Vorderschenkel bläulich an der Innenseite weiss behaart; so auch die Vorderschienen.

“Ich sah von dieser Art nur einige Männchen.

“79. *Halobates sericeus* (Taf. ii. fig. 4).

“H. corpore ovali, subtus argenteo, supra albo cinereo ; oculis flavis.

“Im nördlichen stillen Meere in der Nähe des Aequators.

“Länge  $1\frac{1}{3}$ , Breite  $\frac{2}{3}$  Linien, Körper länglich. Kopf etwas grösser und starker gewölbt, als beim vorigen; mit zwei kleinen Punkten, weissgrau. Augen gelbbraun. Fühler wie beim vorigen; so auch das Halsschild, nur sind hier die Quereindrücke stärker. Mittelleib vorn deutlich breiter, als das Halsschild, anderthalbmal so lang als Kopf und Halsschild zusammen, in der Mitte ein wenig erweitert, Oberfläche vorn schwach gewölbt, hinten flach, weissgrau, ohne Glanz; Hinterleibsriicken von derselben Farbe. Körper unten silberweiss, flach. Vorderbeine grau, hintere Beine schwarz.

“Von dieser sehr häufigen Art sind mir beide Geschlechter vorgekommen.



“ 80. *Halobates flaviventris* (Taf. ii. fig. 5).

“ H. corpore cylindrico, subtus argenteo, supra albo ; abdomine maculisque pectoris apice flavis.

“ Im südlichen atlantischen Meere.

“ Länge 2 Linien, Breite  $\frac{2}{3}$  Linien. Kopf stark gewölbt, weiss, im Rücken eine gelbliche erhabene Linie. Fühler fast so lang als der Mittelleib, schwarz; das erste Glied viel länger als die übrigen etwas dickern, das zweite etwas länger als jedes der beiden letztern unter sich gleich langen Glieder. Augen bei einem Exemplare ganz schwarz, beim andern gelb.

“ Halsschild dritthalbmal so breit als lang, weiss, mit zwei eingedrückten Punkten. Mittelleib vorn viel breiter als das Halsschild, lang, in der Mitte kaum breiter als an beiden Enden, vorn gewölbt, hinten platt mit zwei eingedrückten Punkten. Körper unten silberweiss; der Bauch und ein grosser Fleck auf dem hervorragenden Theile der Brust, welcher die mittlern Beine trägt, gelb. Vorderbeine im Verhältniss zu den übrigen Arten lang, schwarzgrau; die übrigen Beine sehr lang und fein, schwarz.

“ Ich sah nur zwei Weibchen. Ein *Halobates*, der sich im Brittischen Museum befindet, ist in der Nähe des Ausflusses des Congostroms gefangen worden; zu welcher Art er aber gehöre, ist mir nicht bekannt.”

[Though the description of the genus is erroneous in several important particulars (the rostrum is four and not three-jointed, the front tarsus is two and not three-jointed, and the hind tarsus is one-jointed, and has, as well as the middle tarsus, claws), it must be remembered that appliances for the examination of the smaller parts of insects were not so perfect in 1822 as they are now, and that Eschscholtz's descriptions are on the whole much more correct than some subsequent writers have imagined. It is to be noted that he confounded the sexes, a mistake in which he has been followed by almost all his successors.—F. B. W.]

## II.—F. L. DE LAPORTE, Comte de Castelnau.

Essai d'une Classification Systématique de l'ordre des Hémiptères. Guérin-Ménéville's *Magasin de Zoologie*, p. 24, 1833.

### “ Genre 4. *Halobates*, Esch.

“ Antennæ sat breves, articulis 4, post primum fractæ ; 1° cæteros unà longitudine æquante ; 3° præcedenti brevior ; ultimo cylindrico, subovato.—Rostrum brevissimum validum.—Tarsi elongati, articulis vix conspicuis ; antici haud unguiculati.—Corpus brevissimum, convexum ; abdominis articulis vix conspicuis, imbricatis.—Pedes postici suprâ intermedios inserti.

“ Tête large, yeux assez saillant ; corselet grand, presque carré, alongé, coupé carrément en arrière ; pas d'écusson ; abdomen ne formant pas la sixième partie de la

longueur du corselet; pattes antérieures courtes, les autres très longues; base des cuisses postérieures placées au-dessus des intermédiaires.

“Ces insectes habitent parmi les plantes marines des mers de l’océan Indien.

“*Halobates micans*, Escholtz., Entom., 1822, p. 106, No. 78.

“Ajoutez: *H. flaviventris* et *H. sericeus* du même, et une nouvelle espèce que nous possédons et qui vient des mers de la *Nouvelle-Guinée*.”

[The author figures in outline *H. flaviventris*, Esch., and gives enlarged drawings of an antenna and front leg. Notwithstanding his remark “*haud unguiculati*,” the front tarsus is represented with two claws. The hind tarsus is represented as two-jointed. Whatever species the drawing was taken from, it certainly does not represent *H. flaviventris*, Esch.—F. B. W.]

### III.—Dr. HERMANN BURMEISTER.

Handbuch der Entomologie. Zweiter Band, p. 208, 1835.

“1. (92.) Gatt. *Halobates*, Esch., Lap.<sup>1</sup>

“Fühler viergliedrig, das erste Glied so lang als das zweite und dritte zusammen, beide von gleicher Länge, das vierte etwas länger und dicker. Augen vorragend, keine Nebenaugen. Mittelbrust ring sehr gross, stark nach hinten verlängert, so dass die Gelenkgruben der Mittelbeine unter denen der hinteren stehen. Flügel fehlen. Beine ungleich, die vorderen kurz mit verdickten Schenkel, aufrechtstehend; Füße zweigliedrig, Krallen in einen Ausschnitt an der Unterseite in der Mitte des zweiten Gliedes befestigt, klein. Die vier hinteren Beine, besonders die mittleren, stark verlängert, fein, verjüngt; Fussglieder ungleich, das erste 6 mal so lang als das zweite, an den hintersten Beinen fast gleich lang, gewimpert. Hinterleib äusserst klein, kegelförmig, eng an den Brustkasten angezogen.

“Die Arten leben auf der Oberfläche des Meeres zwischen den Tropen; drei wurden zuerst von Herrn Eschscholtz auf Kotzebue’s erster Reise um die Welt entdeckt, andere an der Küste von Mexico und Brasilien gefangene befinden sich im Königl. Museum.

“1. *H. micans*.—Corpore conico, subtus argenteo, supra cinereo, aeneo-micante; oculis atris. Long.  $1\frac{2}{3}$ .”

“Esch., Entomogr. (In den *Naturwissenschaftlich. Abhandl. aus Dorpat*, 1823. 8.) p. 163. 78. 6. tab. 2. fig. 3.

“Auf dem südlichen stillen Meere und dem südlichen atlantischen Meere.

<sup>1</sup> “Wie leichtfertig Herrn Laporte’s Untersuchungen zum Theil sind, davon liefert Nichts einen besseren Beweis, als wenn man seine Charakteristik dieser Gattung mit der Natur vergleicht.”

"2. *H. sericeus*.—Corpore ovali, subtus argenteo, supra albo-einereo; oculis flavis. Long.  $1\frac{1}{3}$ ".

"Esch. ebenda p. 164. 79. tab. 2. fig. 4.—Laport. Hém., pp. 24. 4.

"Ziemlich häufig auf dem nördlichen stillen Meere in der Nähe des Aequators.

"3. *H. flaviventris*.—Corpore cylindrico, subtus argenteo, supra albo; abdomine maculisque duabus pectoris apicalibus flavis.

"Esch. ebenda 165. 80. tab. 2. fig. 5.

"Auf dem südlichen atlantischen Ozean."

[Dr. Burmeister follows Eschscholtz in ascribing two joints to the hind tarsus. He is also mistaken in thinking that the relative lengths given by him of the joints of the middle tarsus are generic characters. They, in fact, differ in the various species.—F. B. W.]

#### IV.—ROBERT TEMPLETON, R.A.

Description of a new Hemipterous Insect from the Atlantic Ocean. *Transactions of the Entomological Society of London*, vol. i. p. 230, 1836.

"HYDROMETRIDÆ, Leach.

"Genus *Gerris*, Latr.

"Sub-genus *Halobates*, Eschscholtz (Entomographien).

"Sp. *H. Streatfieldana*, pl. xxii. fig. A.

"Broadly ovate, or lozenge-shaped, brilliant black; eyes, two minute spots near the prothorax, and the sides and apices of the first uncovered pair of abdominal annuli (4th and 5th) rufous; beneath brownish-black, the first five abdominal rings yellowish with rufous apices, offering the appearance of five narrow transverse fasciæ; last rings broad and rufous black. Apterous.

"Length, 0.13 inch.

"Found on the Atlantic Ocean, in longitude 20° under the line.

"This beautiful species was captured nearly midway between the continents of Africa and America, by Colonel Streatfield, 87th R.T.F., whose name I have in consequence done myself the favour to affix to it, as being most appropriate, and as a slight testimony of the grateful recollection I have of his kindness in presenting me with many interesting species of insects and other rarities. The sea was quite smooth, with a gentle swell, at the time the insect was caught; a number were swimming about among the Porpitæ, which formed the first object of attraction, and fortunately directed attention to the insect. The singularity of its distance from any land, and the possibility of its being driven off from the African coast by the south-eastern gales, gave full play to conjecture, and excited our attention to the little creatures in the water, in the hope of ascertaining on what objects it preyed; but all possibility of discovering this was quickly put a period



to by the S.E. trade sweeping over the surface and banishing all traces of the Medusæ and their companions.

"This species obviously belongs to a section or sub-genus distinct from that in which our linear European species are placed, and characterised by the contracted dimensions of the body, and the dilatation of the head and prothorax and the shortness of the latter. When examined minutely we find the whole body covered with minute hairs, those on the legs predominating beneath, the upper curving downwards. The head is somewhat triangular, with two cupped processes laterally, within which lie the bases of the antennæ; two small rufous maculæ are on the sides of the middle line closely adjoining the prothorax. The eyes are large, rufous, semi-globular, and occupy the space between the base of the head and the processes of the antennæ, emarginating the corselet laterally. The antennæ are about two-thirds the entire length of the body; the first joint slender and curved outwards, the last thickest, attenuating towards the tip.

"The prothorax is excessively short, collar-like, and gently channeled above into three sub-equal divisions, which nearly disappear in the dried specimen. The first pair of legs, arising closely to the mesothorax beneath, are moderately long, rather robust; the coxa short, obconic, and curved; the femur slightly *f*-shaped, with four or five strong black spines near its base exteriorly; tibia basally attenuated, arising with a curve from the preceding joint and with four or five strong black spines inferiorly, apically giving origin to a strong obtuse process, which projects backwards and outwards from near the articulation. Tarsus with the two joints sub-equal, the last diminishing in diameter beyond its middle, after giving attachment to two strong claws and an anomalous horny process on the under side, and also furnished with two long curved spines arising from the back part on each side, and lying adpressed among the hairs.

"The metathorax and mesothorax seem confounded together, presenting superiorly an hexagonal figure, a little longer than broad, the anterior side being carried a little forwards, so as to leave the lateral angles behind the centre. The posterior surface is transversely striate from being impressed upon the abdominal rings. The sides in the dried specimen become somewhat hoary from the light thrown back by the minute hairs. Beneath it is somewhat similar in form, but excavated behind, exposing in the sinus the abdominal rings. The sides posteriorly are rugose, with trochantines, from whence proceed directly backwards the coxæ of the last four legs, that of the posterior pair lying beneath the other on each side. The legs are slender, the middle pair exceeding the first, and the last pair the middle, by about one-third.<sup>1</sup> The last also has the apical half of the tibia, and first joint of the tarsus, with a row of long hairs beneath. Above the origins of the legs we find rudimentary processes, which as the insect is apterous, must be looked upon as those of the undeveloped wing."

[This species has apparently not been taken again.—F. B. W.]

<sup>1</sup> The middle legs here described are really the hind legs.—F. B. W.

## V.—LE MARQUIS MAXIMILIEN SPINOLA.

Essai sur les Hémiptères Hétéroptères, p. 64, 1837.

“ Il n'est pas encore démontré que les *Halobates* connus soient des insectes parfaits. Les derniers anneaux de l'abdomen ne paraissent pas être entièrement développés, et si les observations du Comte Alphonse Castiglioni sur les métamorphoses de la *Ploiaria domestica* Scop. méritent notre confiance, comme je le crois, l'exemple de cette larve qui sort de l'œuf avec un simple rudiment d'abdomen confirmerait nos doutes relativement aux *Halobates*.

“ Ex. *Halobates sericeus*, Esch.

“ L'*Hydrometra abbreviata*, Fab. ne serait-elle pas un *Halobates* et est-elle réellement des Pyrénées ? ”

[According to Stål, Fabricius described the larva of *Limnotrechus lateralis* or of *Limnotrechus asper* under the name *Hydrometra abbreviata*.—F. B. W.]

## VI.—Professor ÉMILE BLANCHARD.

Histoire Naturelle des Insectes. t. iii. p. 98, 1840.

“ *Halobates*, Esch., Lap.

“ Ce genre a la plus grande analogie avec celui des *Gerris*, il n'en diffère réellement que par la forme ramassée du corps, et surtout de l'abdomen, dont les segments sont très-courts et relevés ; les antennes aussi sont beaucoup plus courtes, leurs pattes n'atteignent un aussi grand développement et les organes du vol manquent totalement.

“ Les *Halobates* courent sur les eaux de la mer près des côtes ; on n'en a jamais rencontrés pourvus d'élytres et d'ailes : ce qui, joint à la forme rabougrie de leur corps, a fait présumer que ces insectes n'avoient pas atteint leur entier développement et qu'ils pourroient bien être de véritables *Gerris* à l'état de larve.

“ Eschscholtz en a fait connaître plusieurs espèces dans son Entomographie.

“ 1. *Halobates micans*.

“ Esch., Ent., p. 163, n. 78, tab. 2. fig. 3.—Burm., Handb. der Ent., t. ii. p. 208, n. 1.

“ Long. 2 lig.—Corps cône, grisâtre en dessus, chatoyant le bronzé, entièrement d'un blanc argenté en dessous ; yeux noires ; pattes grisâtres, couvertes de duvet argenté comme les autres parties du corps.

“ Cette espèce vit dans l'Océan-Atlantique.

“ 2. *Halobates sericeus*.

“ Esch., Ent., p. 164, n. 79, tab. 2. fig. 4.—Lap., Hémipt., p. 24, n. 4.—Burm., Handb. der Ent., t. ii. p. 209, n. 2.

“ Long. 1 lig.  $\frac{1}{2}$ .—Cette espèce se distingue de la précédente par son corps plus ovalaire et d'une moindre taille, par ses yeux d'un jaune pâle et le duvet qui recouvre le corps d'un gris-blanchâtre.—Cette espèce se trouve dans les mers équatoriales.”

## VII.—C. J. B. AMYOT and AUDINET SERVILLE.

Histoire Naturelle des Insectes. Hémiptères, p. 411, 1843.

“ Genre 335.—Halobate. *Halobates*, Esch.

Lap.—Burm.—Blanch.

“ *Tête* triangulaire, avec un prolongement court et mousse entre les antennes.—*Yeux* gros, globuleux, saillants, débordants un peu les côtés du prothorax.—*Ocelles* nuls.—*Antennes* de quatre articles cylindriques ; le second un peu plus court que le premier ; le troisième un peu plus long que le premier et que le dernier (dans les larves, le premier est aussi long que tous les autres pris ensemble ; le second à peine plus long que le troisième) ; le quatrième un peu épaissi et à peine plus long que le second.—*Bec* très-court, gros à la base et pointu au bout (dans les larves, les deux premiers articles, qui semblent n'en former qu'un seul, sont courts, annuliformes ; le troisième le plus long, le quatrième court).—*Prothorax* en losange aux quatre côtés à peu près égaux, s'étendant postérieurement à angle aigu et couvrant entièrement le mésothorax (très-court dans les larves, avec le mésothorax très-grand, formant la majeure partie du corps, et point d'écusson).—*Élytres* un peu plus longues que l'abdomen, assez amples, offrant deux cellules basilaires allongées et trois discoïdales à la suite ; ailes un peu plus courtes que les élytres (les élytres et les ailes manquant, suivant tous les auteurs qui n'ont vu que les larves).—*Abdomen* conique, à peu près aussi long que le reste du corps (très-petit, presque non apparent en dessus dans les larves, tous les segments pouvant néanmoins être comptés sous le ventre et les organes sexuels assez développés).—*Pattes antérieures* courtes ; cuisses un peu épaissies ; jambes avant une dent à l'extrémité ; tarses de deux articles à peu près d'égale longueur, cylindriques ; crochets insérés dans une échancrure au milieu du deuxième article ; pattes intermédiaires très-longues, filiformes, insérées très-loin des pattes antérieures à cause de la grandeur du mésosternum, les postérieures très-fines, plus courtes que les intermédiaires, très-près des quelles elles sont insérées ; cuisses intermédiaires plus longues que les jambes ; les quatre derniers tarses de deux articles cylindriques, frangés, dont le premier six fois plus long que le second dans les tarses intermédiaires, tous deux presque d'égale longueur dans les tarses postérieures ; crochets ne nous paraissant pas exister ?

“ Du grec ἄλως ? aire, et βαίνω, marcher.

“ On avait soupçonné déjà que les individus sur lesquels ce genre avait été établi, n'étaient que des larves ; nous en avons la preuve aujourd'hui, d'après l'espèce ailée que nous décrivons ci-après. Mais un fait qui n'avait jamais été relevé, c'est que De Géer paraît évidemment avoir décrit et figuré (Mém. III. 320, 321, 322 ; et pl. 16, fig. 16, 17, 18, et 19) des larves et une nymphe de ce genre, observées par lui en Suède, quoique toutes les espèces existant maintenant dans les collections viennent des tropiques, où on les trouve à la surface des mers. Cet auteur tombant en cela, ce nous semble, dans la plus étrange erreur, n'a voulu les considérer que comme *les petits* d'une espèce de Gerris, et cependant il a décrit et figuré la nymphe elle-même avec ses moignons d'ailes et l'abdomen aussi court que dans la larve, quand il décrivait et figurait plus haut la larve de cette espèce de Gerris avec l'abdomen aussi développé que dans l'insecte parfait, d'où résultait la preuve que l'abdomen conservait toujours la même proportion relative dans les différentes périodes de développement de l'insecte, et que par conséquent il y avait là deux espèces différentes. Latreille (Nouv. dict. hist. nat. [1803] IX. 415) à rapporté toutes les observations de De Géer à ce sujet, en se laissant abuser lui-même par l'auteur, et continuant à prendre les uns pour les petits des autres ;<sup>1</sup> mais ce qu'il y a de singulier, c'est qu'il ait dit ensuite (*loc. cit.*, 416) que l'espèce à laquelle appartenaient ces *petits* à abdomen avorté, était des Indes-Orientales, quand il avait dit une page plus haut (*id.* 414) que De Géer avait observé en Suède les trois espèces dont il parlait.

“ 1. H. albinerve. *Halobates albinervus*.”

[This fresh-water species has been removed to the genus *Brachymetra*, Mayr, and therefore need not be further considered here, beyond calling attention to the fact that of course the generic characters of *Halobates*, Esch., are not the same as those of *Halobates*, Amyot et Serv.—F. B. W.]

“ 2. H. soyeux. *Halobates sericeus*, Esch.

“ Entomogr., *Trans. des Sciences nat. de Dorpat*, 1823. 3, p. 164. 79. tab. 2. fig. 4.—Burm., Ent. ii. 209. 2.—Blanch., Hist. nat. ins. iii. 98. 2.

“ (Long., 9,004). Larve. Corps ovulaire, d'un soyeux blanchâtre en dessous, d'un cendré grisâtre en dessus. Mâle et femelle.

“ Cap de Bonne-Espérance. M. Burmeister dit : Du nord de la mer Tranquille, près de l'Equateur.”

<sup>1</sup> The authors remark in the *errata* (p. 648), “ Au lieu des cinq lignes qui suivent et où nous avons mal interprété la pensée de Latreille il faut lire ce qui suit : Il avait bien distingué toutefois trois espèces dans les individus décrits et figurés par De Géer, la troisième étant celle dont la larve et la nymph avaient l'abdomen tronqué ; mais il s'est trompé en attribuant à cette espèce la synonymie du *Gerris paludum*, Fabr., dont la larve et la nymphe ont l'abdomen aussi développé que l'insecte parfait.”



## VIII.—Dr. G. A. W. HERRICH-SCHÄFFER.

Die wanzenartigen Insecten. Band viii., p. 108, tab. cclxxxvi., 1848.

“Genus *Halobates*, Esch.

“Eine ganz eigenthümliche Form; eiförmig, mit grossem Kopfe, grossen vorstehenden Augen, kurzem Thorax, vorstehenden Schultern, ohne Spur von Flügeldecken und Flügeln, langen Beinen, deren vorderste die dicksten und kürzesten, deren vier hintere weit hinter der Mitte des Körpers eingefügt, seitlich ausserordentlich von einander entfernt sind und deren Glieder sich endwärts haarförmig verdünnen. Die Mittelbrust ist ungemein gross und reicht weit hinter die Mitte des Körpers. Der Hinterleib ist äusserst klein, conisch, beim Weibe mit eckigem Anhang.

“Schnabelscheide bis zur Mitte der Hinterbrust reichend, dreigliederig, das mittlere Glied am längsten; Fühler von mehr als halber Körperlänge, fadenförmig, Viergliedrig, das erste Glied am längsten. Nebenaugen kann ich nicht entdecken. Der Prothorax ringförmig, unten mit breiter, seichter, nicht scharf begrenzter Längsrinne; die Vorderbeine entspringen am Hinterrande der Vorderbrust, nahe beisammen. Die Mittelbrust nimmt mehr als die halbe Körperlänge ein, die Mittelbeine sind an ihren hinteren seitlichen Ecken in ungeheurer Entfernung von einander eingefügt. Die Hinterbrust ist ganz von der Mittelbrust verdeckt und steht nur jederseits an der oberen Körperfläche als Lappen vor, so dass die Hinterbeine kaum etwas weiter nach rückwärts eingefügt sind als die Mittelbeine, aber etwas höher. Keine Spur von Einfügungsstellen der Flügel oder Decken.—An den Vorderbeinen alle Glieder ziemlich gleich dick, also fadenförmig; Hüften kurz, Schenkel etwas länger als die Schienen; Fuss kürzer, zweigliederig, das erste Glied kürzer. Die vier Hinterbeine borstenförmig, die mittlern länger; die Glieder der Füsse kann ich nicht genau unterscheiden; es scheinen deren zwei, das zweite viel kürzer.

“Die Arten leben auf der Oberfläche des Meeres zwischen den Tropen, wahrscheinlich gesellschaftlich; Burmeister kennt mehrere Arten.

“I. Vorderschienen am Ende erweitert, Vorderfuss mit zwei Krallen in einem Ausschnitte der Mitte des Endgliedes, Schenkel aller Beine länger als ihre Schienen. Die Hintertarsen (nur des Mannes?) lang borstig. Körperfläche grau, durch feine Behaarung seideglänzend.”

“Tab. cclxxxvi. fig. 880 mas, 881 foem.

“*Halobates sericeus*, Esch.

“*Cinereus*, oculis subferrugineis.

“Eschscholtz, Entomographien, 1822, t. 2. fig. 4.

“Aschgrau, die Augen braungelb.

“Beide Geschlechter von Herrn Sturm, welcher sie aus der Südsee von Herrn Eschscholtz erhielt.

“Folgende Arten sind mir unbekannt :

“*H. micans*, Esch., Entom., t. 2. f. 3.—Burm., p. 209.

“*Cinereus oculis atris*.

“Aschgrau, die Augen schwarz.

“Aus dem südlichen stillen und atlantischen Meere. Herr Eschscholtz sah nur einige Männchen.

“*H. flaviventris*, Esch., Entomogr., t. 2. fig. 5.—Burm., p. 290.

“*Cinereus oculis atris*, abdomine et pectoris apice flavescens.

“Vielleicht das andere Geschlecht zu voriger, aus dem südlichen atlantischen Ocean; Herr Eschscholtz sah nur zwei Weibchen.”

II. Vorderschienen ohne Erweiterung, Vorderfuss ohne Krallen ; Schenkel der Mittelbeine kürzer als ihre Schienen, Schenkel der Hinterbeine lang borstig ; Körper glatt, fleckig.”

[In this section is placed *Halobates pictus*, Germ., which, being a fresh-water and not a marine species, and being moreover not a true *Halobates*, need not be further considered. In the generic description some of Eschscholtz' mistakes are repeated.—F. B. W.]

#### IX.—LÉON FAIRMAIRE.

*Annales de la Société Entomologique de France.* Bulletin Entomologique. Année 1848.  
Deuxième Trimestre, p. xxvi.

“M. Amyot, dans son *Histoire Naturelle des Hémiptères*, p. 412, dit : ‘On avait déjà soupçonné que les individus sur lesquels ce genre avait été établi n’étaient que des larves, nous en avons la preuve aujourd’hui d’après l’espèce ailée que nous d’écrivons ci-après.’

“MM. Burmeister et Spinola, sans être aussi affirmatifs, croient aussi qu’on ne connaît encore que les larves des *Halobates*. Il n’y a que le fondateur du genre, Eschscholtz, et M. E. Blanchard, qui n’expriment aucun doute sur l’état parfait de ces insectes. Je crois être à même de résoudre cette question en détruisant l’argument apporté par M. Amyot, et en apportant des preuves directes à l’appui de mon opinion.

“M. Amyot décrit sous le nom d’*H. albinervus* un insecte très voisin des *Gerris*, ailé et provenant de capitainerie de Goyaz ; or, cette province, située entre des montagnes, est à 200 lieues de la mer, ce qui exclut toute idée d’insecte maritime et explique pourquoi l’auteur ne veut pas admettre les *Halobates* tels qu’ils ont été décrits par Eschscholtz.

“Notre collègue M. Ch. Coquerel, à qui nous devons des observations intéressantes

sur l'entomologie de Madagascar, a rapporté des mers qui avoisinent cette île un certain nombre de véritables *Halobates* aptères, de tout âge, de tout sexe et de deux espèces, parfaitement conservés dans de l'esprit de vin. Parmi eux se trouvaient deux énormes femelles, au ventre rebondi, qui au premier coup d'œil, me parurent porter dans leur flancs la solution de la question. En effet, avec l'aide du scalpel, je fis sortir de l'abdomen 15 ou 20 corps oblongs, assez gros, d'un jaune soyeux pâle, qui envahissaient même une portion du thorax : c'étaient des œufs.

“Maintenant se présente une objection. Les œufs prouvent-ils l'état parfait de la mère ? Selon moi, oui, jusqu' à preuve du contraire. Je sais bien qu'il y a quelques exemples du contraire dans les Orthoptères : ainsi M. Ch. Coquerel m'a montré un kakerlac pondant des œufs et n'ayant encore que des moignons d'élytres ; mais je ne crois pas que dans l'ordre des Hémiptères on ait encore signalé pareille anomalie. M. Amyot veut qu'un insecte ne puisse être parfait sans ailes ; mais qu'entend-on par état parfait ? Il me semble qu'il ne saurait y avoir d'ambiguïté : c'est l'état de puberté, c'est le moment où l'insecte jouit de toutes ses facultés, et celle de se reproduire est plus importante que celle de voler. Quant aux ailes, il est vrai qu'elles sont le signe patent de la perfection, mais elles ne sont pas indispensables : dans les Coléoptères, nous en avons de fréquents exemples, et dans les Hémiptères la punaise des lits nous prouve tous les jours que certains insectes peuvent vivre, s'accoupler et mourir sans ailes. Dira-t-on qu'elle n'arrive jamais à l'état de perfection ? D'ailleurs, pour les *Halobates*, naviguant le plus souvent à des centaines de lieues de tout rivage, à quoi leur servirait d'être ailés ? Leur corps me semble destiné à se passer de ces aides aériens : les anneaux supérieurs de l'abdomen sont convexes, coriaces, et on distingue à peine la suture des premiers avec le thorax et entre eux : il y a bien de chaque côté une sorte de moignon d'aile, mais il est à l'état rudimentaire et semble n'être placé là que pour la forme.

“Les espèces qui m'ont fourni ces observations sont les *Halobates flaviventris* et *sericeus*, que M. Ch. Coquerel a trouvés ensemble, le premier beaucoup plus rare que le second, et presque toujours sur les *Fucus*, appelés vulgairement *raisins des tropiques*. Notre collègue, qui en a remarqué des milliers, n'a jamais vu un seul individu ailé, particularité qui ne lui aurait pas échappé.”

#### X.—CARL STÅL.

Nya Hemiptera. *Öfversigt af Kongl. Vetenskaps-Akademiens Föreläsningar*. Elfte Argangen, No. 8, p. 238, 1854.

#### “*Halobates*, Esch.

“1. *II. lituratus* : *II. picto* similis ; sordide flavotestaceus ; thorace margine antico, lineis 4 fere basalibus abbreviatis, mediis utrimque oblique transversis, curvatis, media

longitudinali, laterali utrimque subrecta, nigrofuscis; femoribus anticis utrimque longitudinaliter, tibiis tarsisque totis nigricantibus. Long. 5, lat.  $2\frac{3}{4}$  millim.—China.”

[This species is not a true *Halobates*, but is the type of a new genus.—F. B. W.]

#### XI.—Dr. GEORGE CARL BERENDT.

Die im Bernstein befindlichen organischen Reste. Bd. ii. p. 19, tab. ii. fig. 8, 1856.

- [Dr. Berendt describes and figures an insect which he considers may perhaps be the larva of a *Halobates* or some allied genus. The figure shows rudiments of elytra and wings, besides other characters not belonging to *Halobates*. Under these circumstances, further consideration of it is not necessary.—F. B. W.]

#### XII.—CARL STÅL.

Kongliga Svenska Fregatten Eugénies Resa. Insekter. Hemiptera, p. 264, 1858.

“Fam. PLOTERES.

“124. *Halobates lituratus*.

“Flavo-testaceus; antennis basin versus exceptis, fuscis; macula intraoculari obsoleta, vitta thoracis, scutelli margine basali tenuissime, lineis quatuor basalibus (intermediis longioribus, apicem versus sublatis), lineaque percurrente media et postice utrimque linea intus latiore, apicem versus angulata et in pectore continuata, hujus etiam linea laterali, tibiis tarsisque nigro-fuscis; femoribus anticis intus et extus vitta fusca, apud ♂ incrassatis. ♂ ♀. Long. 5, lat.  $2\frac{3}{4}$  millim.

“*Halobates lituratus*. Stål, Öfv. af K. Vet.-Ak. Förh., 1854, p. 238.

“Patria: China (Wampoa).

“*H. picto* affinis, pictura aliter distributa. Caput flavo-testaceum, maculis una majore vel duabus minoribus intraocularibus fuscis. Antennæ corporis fere dimidia longitudine, fuscae, basin versus flavo-testaceae. Thorax flavo-testaceus, linea longitudinali media, margine antico et interdum macula utrimque prope lineam longitudinalem nigro-fuscis. Scutellum flavo-testaceum, lineis longitudinalibus, una media percurrente, unaque antice utrimque cum macula oblonga vel vitta suboblique longitudinali brunnescente coherente, margine antico anguste lineaque utrimque posteriore oblique longitudinali, apice rotundato-angulata et in pectoris latere retrorsum currente, nigro-fuscis; pectore etiam linea percurrente striolaque disci utrimque longitudinalibus nigro-fuscis. Pedes fusci, femoribus flavo-testaceis, anticis utrimque fusco-vittatis, apud marem incrassatis.”



## XIII.—Dr. ANTON DOHRN.

Zur Heteropteren-Fauna Ceylon's. *Stettiner Entomologische Zeitung*, vol. xxi., p. 408, 1860.

“103. *Halobates Ståli*, n. sp.

“*H. supra niger, opacus*; capite sordide flavo-testaceo, macula magna media, 3 anticis minoribus nigris, oculis fusco-fulvis, nigro-maculatis; thorace antice maculis 2 semicircularibus, postice 2 mediis parallelis longitudinalibus, 1 utrimque uti comma figurata aliaque utrimque transversali, semicirculari, tertia utrimque minore apice disci, tunc in parte prope insertionem pedum una transversali, 2 longitudinalibus, 3 apicalibus, minoribus flavo-testaceis; subtus cum lateribus flavo-testaceis, his longitudinaliter nigro-strigatis, macula supra coxas anticas, lineisque 2 plus minusve latis femorum anticorum nigris; antennis, pedibusque mediis posticisque nec non tibiis anticis nigrescentibus; rostro flavo-testaceo, apice nigro.—7 millim.”

[This is probably congeneric with *H. lituratus*, Stål.—F. B. W.]

## XIV.—Dr. GUSTAV L. MAYR.

Reise der österreichischen Fregatte Novara um die Erde. Zoologischer Theil, Band ii. Abth. 1. Hemiptera, p. 177, 1866.

“HALOBATES, ESCH.

“Dorp., Abh. i., 1822.

“*H. lituratus*, Stål.

“*Halobates lituratus*, Stål, Eug. Resa, Ins., p. 264 (1858).

“Hongkong.

“Dr. Stål's Beschreibung ist durch Folgendes zu ergänzen: Die Schnabelscheide reicht nur bis zum Vorderrande der Mittelbrust; die Vorderschienen haben am Ende einen zahnartigen Fortsatz und sind daselbst nicht erweitert (bei *H. pictus*, Herr.-Schaeff. soll dieser Fortsatz fehlen), zweites Tarsenglied der Vorderbeine unten nahe der Mitte mit einem Ausschnitte, in welchen die Krallen eingefügt sind; die Schenkel der vier hinteren Beine sind länger als die Schienen (während nach Herrich-Schaeffer bei *H. pictus* die Mittelschenkel kürzer als die Mittelschienen sind). Da Dr. Stål angibt: ‘*H. picto affinis, pictura aliter distributa*,’ so sollte man meinen, dass sich *H. lituratus* von dieser Art nur durch die Färbung unterscheidet. Wenn aber die von mir untersuchten Exemplare richtig bestimmt sind (was wohl vorauszusetzen ist, da Stål's Beschreibung mit denselben übereinstimmt), so finden sich bei *H. lituratus* Merkmale, welche diese Art von *H. pictus* wesentlich unterscheiden.”

## XV.—GEORG RITTER VON FRAUENFELD.

*Verhandlungen der kaiserlichen und königlichen zoologisch-botanischen Gesellschaft in Wien.*  
Band xvii. pp. 456–460, Taf. xii. fig. 1–10. 1867.

“*Halobates Wüllerstorffi*, n. sp. Bei Cap Frio nächst Rio Janeiro 20–30 Meilen vom Lande.

- “*Halobates flaviventris*, Eschsch. In der Nähe der Nicobaren.

“*Halobates lituratus*, St. Im chinesischen Meere.

“*Halobates micans*, Eschsch. Vor Ceylon, beiläufig 3° N. Br.

“Eschscholz hat die Gattung *Halobates* in seinen Entomografien aufgestellt. Es ist das einzige wirklich und ausschliesslich im Meere lebende Insect, da ich ausserdem nur ein Paar Fliegerlarven kenne, die ihre Verwandlung im Seewasser bestehen, Belostomen aber, die öfter schon im Meere gefangen wurden, bestimmt nur zufällig und ausnahmsweise sich daselbst finden. Sie hüpfen auf der Oberfläche des Wassers in grossen Schaaren gesellig in meilenweiter Entfernung vom Lande umher.

“Eschscholz beschreibt und bildet 3 Arten ab: *micans*, *sericeus* und *flaviventris*. Templeton hat in der Trans. of the ent. Soc. eine neue Art.: ‘*Streatfieldana*’ beschrieben. Zwei weitere Arten *pictus* Grm. und die in ‘*Eugenie’s Resa*’ von Stål neuerlichst beschriebene ‘*lituratus*’ unterscheiden sich von jenen vier einfarbigen Arten durch ihre bunte Zeichnung. Die von Am. Serv. als *Halobates albinervus* aufgestellte Art wurde von Gust. Mayr wegen der vorhandenen Flügeldecken als Gattung *Brachymetra* abgetrennt. *H. sericeus* und *pictus* sind in den wanzenartigen Insecten von Herrich-Schäffer auf. Taf. 286 abgebildet.

“Ich habe die Seewanzen während der Fahrt mehrfach beobachtet und mehrere Arten vom Fenster meiner Cabine aus mit einem Netze an einer langen Stange aufgefischt. *H. lituratus* St. fing ich auf der Fahrt von Manila nach Hongkong mitten im chinesischen Meere. Von einfarbigen Arten habe ich 3 beobachtet, und zwar eine, die für unbeschrieben halte, *H. Wüllerstorffi* bei Cap Frio nächst Rio Janeiro, ferner eine vor Ceylon in beiläufig 3° N. Br., welche ich zu *H. micans*, Esch. ziehe, und eine dritte endlich, in grosser Anzahl in der Nähe der Nicobaren, welche ich zu *flaviventris* Esch. bringe, obwohl sie nicht besonders mit dessen Beschreibung übereinstimmt. Von dieser letzten von welcher Eschscholz nur 2 Weibchen sah, habe ich beide Geschlechter und eine grosse Menge Larven gefangen.

“Eschscholz sagt in seiner Gattungs-Diagnose: Tarsi antici triarticulati; die Füsse dieser Beine scheinen von oben betrachtet nur aus 2 ziemlich langen dicken Gliedern zu bestehen, aber an der Unterseite des zweiten längern Gliedes bemerkt man noch ein drittes sehr kurzes, abstehendes Glied, das am Ende mit 2 gekrümmten Haken bewaffnet ist.

“Dieses zweite Glied hat in seiner Mitte unten einen Ausschnitt, in dessen Grund die Doppelklaue eingefügt ist, zwischen der eine gleichfalls gekrümmte feine Borste sitzt. Der unterhalb stehende, die Klauen nicht überragende Fortsatz ist schlank keglich. Ich habe nur nach starken Pressen bei völliger Zertrümmerung des Gliedes dieses Zäpfchen abzutrennen vermocht. Es dürfte also vielleicht nicht als drittes Glied zu bezeichnen sein, um so mehr, als die Klauen am Grunde desselben sitzen (fig. 8, 9, 10).

“Ich will die neue Art und das Männchen von *H. flaviventris*, Esch. beschreiben, und den übrigen das zur Ergänzung Nöthige beifügen.

“*H. Wüllerstorffi*, n. sp. (fig. 1, 2).

“Schwarz, aschgrau bereift, namentlich an den Seiten und am Bauch lichter seiden-glänzend. Alle Beine glänzend stahlblau.

“Kopf dreieckig, etwas schmaler als das Halsschild. Die grossen schwarzen Augen jedoch weit darüber vorstehend. Halsschild in der Mitte hinten und vorn eingeschnürt, mit 2 nur bei dem Männchen sichtbaren leichten Quereindrücken. Der hoch gewölbte Mittelrücken vorn etwas breiter als das Halsschild; oval, bei dem Männchen an der Seite stärker gebauht, bei dem Weibchen daselbst etwas weniger. Der sehr reduzierte Hinterleib beim Männchen abgerundet, beim Weibchen mit einem grossen, bei allen Arten dieser Gattung gewöhnlichen rautenförmigen Anhang. Die schwarzen Fühler (fig. 6) viergliederig. Erstes und zweites schlank, gleichdick, an der Spitze etwas geknöpft, das erste zweimal so lang als das zweite, das dritte und vierte merklich verdickt, cylindrisch, an den Enden abgerundet; zwischen dem zweiten und dritten Glied eine kleine runde Abschnürung, die dem dritten Gliede angehört. Das dritte Glied merklich kleiner als das zweite. Das vierte etwas grösser als das zweite, mithin fast  $1\frac{1}{2}$  mal so lang als das dritte. Vorderbeine kräftig; Hüften der Mittelbeine sehr kurz, jene der Hinterbeine mehr als 3 mal so lang, cylindrisch. Schenkel der Mittelbeine dicker als jene der Hinterbeine und  $1\frac{2}{3}$  mal so lang. Schienen dünner wie die Schenkel, doch auch diese an den Mittelbeinen etwas dicker als an den Hinterbeinen; an beiden gleichlang. Tarsus zweigliedrig; an den Mittelbeinen das erste Glied wenig kürzer als die Schienen, etwas gekrümmt, zweites Glied sehr kurz. An den Hinterbeinen beide kurz. Sämmtliche Beine des Männchens sind glänzend stahlblau; beim Weibchen sind jedoch nur die Vorderbeine und die Hüften der Hinterbeine stahlblau, Schenkel und Schienen dieser zwei Beinpaare, die auch etwas länger als beim Männchen sind, schwarz, mit sehr schwachem blauen Schein. Füsse und Fühler sind zart behaart.

“♂ Lang 4 mm., breit an der dicksten Stelle 2.5 mm. Schenkel der Mittelbeine lang 4.5 mm.

“♀ Lang 4.3 mm. mit dem rautenförmigen Anhang, breit an der dicksten Stelle 2.35 mm. Schenkel der Mittelbeine lang 5 mm.

“*H. micans*, Esch. Von dieser Art habe ich gleich Eschscholtz nur Männchen gefangen; (Zool. Chall. Exp.—PART XIX.—1883.)

sie gleicht sehr der so eben beschriebenen *H. cyanipes*,<sup>1</sup> nur sind die Fühler (fig. 5), die gleichfalls zwischen dem 2 und 3 Glied eine rundliche Abschnürung haben, schlanker. Das erste Glied ist länger als bei *H. Wüllerstorffi*, dagegen das zweite und dritte fast gleichlang. Auch die Beine sind etwas schwächer als bei jener Art, doch so ziemlich von gleichem Verhältniss; sie unterscheiden sich aber durch die Färbung, indem sie wie Eschscholz angibt, schwarz sind, und nur die Vorderschenkel einen bläulichen Schein haben. Die Färbung des Thieres selbst, die Eschscholz als 'schwarzlichgrau mit Messingglanz, Hinterleibringe weissgrau, unterseite des ganzen Körpers silberweiss' angibt, stimmt nicht ganz genau. Meine Exemplare sind aschgrau bereift, ohne Spur eines gelblichen Glanzes, und auf der Unterseite wohl heller, doch keineswegs silberweiss.

" ♂ Lang 4 mm., breit an der dicksten Stelle 2.25 mm., Schenkel der Mittelbeine lang 4.6 mm.

" *H. flaviventris*, Esch. (fig. 4).

" ♂ Oval, am Rücken nicht sehr hoch gewölbt. Oben licht aschgrau bereift; am Kopf neben den stark hervorragenden, bei verschiedenen Individuen theils hell, theils schwarzbraunen Augen, beiderseits ein braungelber Fleck, die sich am Hinterrande mit einer, schmalen Linie vereinigen. Auf der Seite und unten silberig glänzend. Der ganze Bauch, die Unterseite des Halsringes, die Hüfthöcker der sämtlichen Beine und ein Mittelstreif (fehlt beim Weibchen), der an der Bauchwurzel breiter ist und über die ganze Mittelbrust verschmälert bis zum Halsring zieht, gelb. Die sehr zarten Fühler (F. 7), die nicht jene rundliche Abschnürung wie die beiden vorigen Arten, zwischen dem zweiten und dritten Glied besitzen, an den Wurzeln, häufig bis zur Hälfte des Gliedes gelb. Die kräftigen Schenkel der Vorderbeine gleichfalls an der Wurzel, und eben so oftmals ziemlich ausgedehnt gelb, sonst oben auf schwarz, unten aber durchaus gelb. Die vier sehr zarten Hinterbeine schwarz, nur die Hüften auf der Unterseite gelb. Der After bildet ein stark vorragendes Zäpfchen. Lang 4 mm., breit an der dicksten Stelle 2.25 mm., Schenkel der Mittelbeine 4.6 mm.

" Beim Weibchen habe ich nur zu bemerken, dass auch hier die Fühler an der Wurzel stets mehr oder weniger ausgedehnt gelb sind, wovon Eschscholz nichts erwähnt, sowie dass die Fühlerglieder alle gleichdick sind, und das 2, 3, 4 Fühlerglied gleichlang, während sie Eschscholz ungleich angibt. Auch die Hüften der Vorderbeine, sowie die Unterseite des Halsringes sind wie beim Männchen stets gelb. Das übrige stimmt mit dessen Beschreibung überein.

" Ich bin bei der ausserordentlichen Genauigkeit der Angaben Eschscholz's nicht ganz sicher, ob die von mir gefangene Art wirklich zu dessen *flaviventris* gehört, wollte jedoch auf diese Abweichungen hin keinen neuen Namen geben.

" Die Larven (F. 3), die ich zahlreicher als das ausgebildete Thier gefangen, sind nur wenig kleiner und an denselben kein Geschlechtsunterschied zu entnehmen. Sie sind

<sup>1</sup> "*Cyanipes*" is evidently a *lapsus calami* for "*Wüllerstorffi*."—F. B. W.



lederhäutig, mit einzelnen Chitinplatten, und zwar 2 querovale auf dem Halsring; 2 länglichovale auf der Vorderhälfte des Mittlrückens, hinter jedem derselben ein querenförmiges; auf den 4 ersten der 7 deutlich unterschiedenen Hinterleibsringe an der Seite eine sehr kleine rundliche, eine längliche obenauf am Hüfthöcker der Hinterbeine. Diese sämtlichen Platten sind aschgrau bereift, die Hautdecke dazwischen braun, längs den Seiten des ganzen Leibes gelb, weiss schimmernd, die letzten Hinterleibsringe hellgelb. Die Afterdecke ist schwarz, mit einer breiten gelben Querbinde, von welcher nach vorn eine gelbe Mittellinie geht, die das Schwarz des vordern Theiles mitten trennt. Die Unterseite ist ganz ledergelb. Die Fühler sind wie beim ausgebildeten Thiere, nur matter schwarz. Auch die Vorderbeine sind an der Wurzel gelb, haben jedoch nur ein Tarsenglied, das durch einen Einschnitt unten, etwas ausser der Mitte einen spitzen Zahn trägt. Die Hüften der Hinterbeine unten gelb. Die Farbe sämtlicher Beine matt bräunlichschwarz.

“Ausgebildetes ♂ 4·2 mm. lang, breit 2·4 mm, Schenkel der Mittelbeine 5 mm. lang.

“♂<sup>1</sup> 4·1 mm. lang mit dem Anhang, 1·9 mm. breit, Schenkel der Mittelbeine 5·1 mm. lang.”

[This is the most important paper on the subject since the genus was founded, but the author has curiously adhered to the original error of confounding the sexes. It is to be noted that the species he refers to *flaviventris*, Eschscholtz, is not that species,—a fact of which he seems to have had some suspicion, but he was unwilling to found a new species without a certainty that he was right in so doing,—a very commendable cautiousness.—F. B. W.]

#### XVI.—Professor ENRICO HILLYER GIGLIOLI.

Breve cenno sulla distribuzione geografica dell' emittente Halobates, Eschscholtz. *Bollettino della Società Entomologica Italiana*, Anno secondo, p. 260, 1870.

“Sembrerà strano il fatto di cogliere un insetto in alto mare, a grandi distanze da qualsiasi terra; eppure l'entomologia non manca di rappresentanti anche in mezzo all'Oceano, e di contribuire essa pure il suo obolo alla fauna pelagica.

“Sin dal 1822 Eschscholtz descrisse col nome di *Halobates*<sup>2</sup> un insetto che vive camminando sulla superficie mobile dell' Oceano, come fanno le comuni *Hydrometra* sulle nostre acque stagnanti.

“Le affinità del genere *Halobates* sembrano essere col genere *Gerris* di Latr.; esso infatti comprende insetti piccoli, atteri, con elitre rudimentarie, addome corto e conico, i quali vivono nei mari tropicali. Westwood<sup>3</sup> li considerava come insetti ancora allo

<sup>1</sup> The sign ♂ is here evidently given in mistake for ♀—F. B. W.

<sup>2</sup> Entomographien, I Lieferung, Berlino, pp. 106–111, tab. iii. fig. 3–5, 1822.

<sup>3</sup> Introduction Modern Classific. of Insects, ii. p. 470 (Nota).

stato di larva ed Amyot<sup>1</sup> è dell' istesso avviso, mentre Blanchard sostiene l'opinione dell' Eschscholtz, giudicandoli insetti perfetti. Fairmaire<sup>2</sup> tra individui portati dal Signor Coquerel dai mari del Madagascar, trovò due femmine coll' addome pieno di uova, le quali come molte centinaia d'individui già esaminati *non avevano ali*. Dunque debbono per questo essere considerati larve? *Cui bono* le ali ad un insetto che vive in alto mare?

“Io sono interamente dell' opinione del Fairmaire; e chi ha veduto questi emitteri ad enormi distanze da qualunque terra non può pensare altrimenti.

“Di questo genere varie specie sono già stato descritte. Io non intendo entrare in argomento così intricato che verrà trattato da persone assai più competenti di me nella monografia entomologica del viaggio della ‘*Magenta*’: intendo soltanto accennare alle località ove trovai gli *Halobates* durante il mio viaggio di circumnavigazione. E siccome l'argomento è nuovo, credo che ciò non sarà privo d'interesse.

“Pescai il primo *Halobates* nell' Atlantico Australe il 29 dicembre 1865 in lat. 16° 11' Sud, long. 36° 00' Ob. Parigi; a circa 400 miglia dalla costa Americana. Il giorno seguente ne furono presi altri, ma non erano numerosi.

“Nel maggio 1866, altri *Halobates* furono pescati nello stretto di Banca, golfo di Siam, ed in vicinanza delle isole Pulo Condore, ove il mare per larghissimo tratto era coperto da *Trichodesmium*, sparso alla superficie dell' acqua come minuta segatura.

“Il 10 febbraio 1867 entrammo di nuovo nell' Oceano indiano, in cui trovammo un *Halobates* abundantissimo. Dal 12 febbraio (in lat. 11° 33' S., long. 106° 40', E. Gr.) al 17 dello stesso mese (in lat. 15° 59' S., long. 105° 48' E. Gr.) entro gli stesso limiti il mare era sparso di fiocchi di *Trichodesmium*.

“Traversato il Pacifico, incontrammo di nuovo il nostro emittero abbondante a qualche centinaio di miglia dalla Costa Americana, dal 29 agosto (in lat. 21° 27' S.) al 6 settembre (in lat. 29° 21' S.).

“Finalmente, l'*Halobates* fu ripreso nell' Atlantico, nel viaggio di ritorno (gennaio 1868), in due occasioni; il primo in lat. 26° 38' S., il secondo in lat. 4° 28' Nord.

“Ad un esame non minuzioso tutti questi *Halobates* mi sembravano appartenere ad una sola specie.

“Concluderò col dire come questi strani insetti sono sparsi lungo la zona tropicale in tutti i mari, e non hanno certamente bisogno di alghe per sostenersi sull' acqua, come sembra voler asserire il Coquerel. Io non trovai un solo *Halobates* nel *Mar di Sargasso*, ed il *Trichodesmium* col quale lo trovai associato due volte, non è certamente capace di servir loro da zattera.

“Un ricca serie d'individui dalle diverse località venne reportata, ed in un colle altre collezioni zoologiche del viaggio della *Magenta* si trova nel R. Museo di Torino.”

[Three of Dr. Giglioli's specimens—kindly lent to me by the Turin Museum—are

<sup>1</sup> Hist. Nat. des Hémiptères, p. 412.

<sup>2</sup> Ann. Soc. Ent. de France, sér. 2, t. ii. p. xxvi., 1848.

referrible, partly to *H. Wüllerstorffii* and partly to a new species. What the others may be, I of course cannot say, but it is not improbable that there are other species amongst them.—F. B. W.]

#### XVII.—ROBERT M'LACHLAN, F.R.S.

*The Entomologists Monthly Magazine*, vol. vii. 1870-71.

After giving a summary of Professor Giglioli's paper, the author proceeds to say :—

“These notes have a peculiar interest for me, as exciting reminiscences of a voyage of thirteen months' duration I made when a youth, in 1855-56. This voyage was marked by a most immoderate amount of calms (in one case extending to thirty consecutive days, in the hottest part of the China Sea), and I lost no opportunity of fishing up—and, I am sorry now to say, casting away,—the, to me, wonderful forms always floating around. Long before crossing the line, on the outward voyage, I was struck by small whitish creatures which often appeared coursing with great rapidity over the surface of the ocean; at length one was captured, and I well remember my astonishment on finding it was a spider-like insect, of the affinities of which I then knew nothing. They disappeared, or rather were lost to view, as soon as a breath of wind caused a ripple on the surface, but were common in that most unpleasant form of sea-disturbance in which there are great ‘smooth’ waves, the effect of a recent storm, but with no present wind. In the Atlantic, Indian, and Pacific Oceans, it only needed the required state of the sea to bring these merry coursers to view, and certainly often without the presence of the smallest piece of floating sea-weed. Those who have voyaged will bear me out when I say that, excepting in the mysterious Sargasso-sea, in the course of the oceanic currents, and in the vicinity of land, sea-weed may be looked for with as much chance of finding it as daisies. I should here state that the brilliant white appearance of the insect on the ocean is caused by the pellicle of air that surrounds it, the creature itself being blackish. If these notes should be read by any one of those ‘who go down to the sea in ships,’ I would remind him that, if he can throw any light upon the life-history of this most wonderful insect (how many species there may be I know not), he will confer the utmost benefit upon natural science. The *Trichodesmium* alluded to by Giglioli is a minute confervoid plant which sometimes covers the surface of the ocean like fine sawdust.”

#### XVIII.—Professor KARL SEMPER.

*The Natural Conditions of Existence as they affect Animal Life*, p. 144; also note on p. 434, 1881.

“In the Pacific Ocean and Philippine Sea I have myself often found various insects and even spiders in the sea, sometimes swimming in great numbers on the surface, sometimes

creeping between rocks under water by the shore. A bug of the genus *Halobates* (fig. 35) is particularly common in these seas, besides the above-mentioned larvæ of flies. This genus was discovered by Eschscholtz, and now includes fourteen species living in seas the most remote from each other. The species in question runs about like our Water-Bug, *Hydrometra*, in great numbers and in every stage of development, on the high seas hundreds of miles from land."

And a note on p. 434: "Eight species of the genus, as I am informed by my friend Dr. Hagen, have been described; that described in the text and discovered by me is a new species and the largest of all. They are found in the Atlantic, Indian, and Pacific Oceans, as well as in the Chinese Sea, but only in tropical or sub-tropical regions."

[Professor Semper tells me that the woodcut given in his work is a correct representation of the species referred to, and that the expression "now includes fourteen species" was written by mistake. The species in question probably belongs to a new and undescribed genus.—F. B. W.]

In addition to the literature reproduced above, there are various other references to the genus, but as they contain nothing of importance it is unnecessary to mention them further.

In addition to the specimens taken by the Challenger expedition, I have had the advantage of having been able to study specimens belonging to several museums and private collections, both in Britain and on the continent of Europe; and my best thanks are due to all those who have in this and other ways assisted me. The museums to which I am indebted for the loan of specimens are the following:—Berlin (through Dr. Peters), Brussels (through M. A. de Borre), Liverpool (through Mr. T. J. Moore), Oxford (through Professor Westwood), Stockholm (through M. C. Aurivillius), Turin (through M. L. Camerano), Vienna (through Dr. Rogenhofer). I have also to thank Professor Westwood, of Oxford; Dr. Signoret, of Paris; Mr. J. W. Douglas, of London; and Dr. G. Hay, of Aden, for the loan or gift of specimens from their private collections; and for information and other assistance, Mr. John Murray of the Challenger; Mr. R. M'Lachlan, F.R.S.; Dr. Murie, the Librarian of the Linnean Society; Dr. Dohrn, of Stettin; M. L. Fairmaire, of Paris; Dr. G. L. Mayr, of Vienna; Mr. C. Ritsema, of the Leyden Museum; Professor Semper, of Würzburg, Mr. J. T. Carrington, F.L.S.; the naturalists of the British Museum; and lastly, Mr. Edwin Wilson, for the painstaking skill with which he has drawn the illustrations.



## II. ANATOMY AND DESCRIPTION OF GENERA AND SPECIES.

---

On examining the various species that have been placed in the genus *Halobates*, it soon became evident that they could not with propriety be retained in one genus, and that, in fact, they make part of at least three genera. As, however, this paper deals only with those genera, some, if not all, of the species of which are marine, two genera only require to be noticed. These are *Halobates* proper and a new genus *Halobatodes*. Had the species of the latter genus not existed, there would also be grounds for establishing a new sub-family for the genus *Halobates*. As it is, *Halobatodes* (of which the typical species is *Halobates lituratus*, Stål) and *Stephania* (a new genus proposed for the reception of *Halobates pictus*, Germar) form connecting links between *Halobates* and the more typical genera of the sub-family *Hydrobatina*, in which *Halobates* has hitherto been placed. To retain it in this position, however, some modification in the definition of the sub-family will be necessary; as, for example, in this respect, that, while the *Hydrobatina* are said to have two-jointed tarsi, *Halobates* has the hinder tarsi only one-jointed.

The two genera under consideration may be thus distinguished:—

1. Body thickly clothed with short pubescence; front tibia with a triangular dilatation near the apex; middle tibia and first joint of tarsus with a long fringe; hind tarsus with one joint, . . . . . *Halobates*
2. Body more sparsely clothed with short pubescence; front tibia cleft, but not with a triangular dilatation at the apex; middle tibia and tarsus without a long fringe; hind tarsus with two joints, . . . . . *Halobatodes*.

### HALOBATES, Eschscholtz.

Entomographien, i. p. 106, 1822.

*Body* oval or oblong.

*Head* shortly triangular.

*Antennæ* four-jointed, with two intermediate jointlets. First joint always the longest.

*Rostrum* four-jointed; first and second joints very short, the latter ringlike; third joint the longest.

*Eyes* large, situated at the back of the head, and resting partly on the pronotum.

*Prothorax* transverse, much broader than long, not confluent with the mesothorax.

*Mesothorax and metathorax* together cylindrical, coalescent, the boundary between them scarcely distinguishable; no scutellum nor scutellar process.

*Elytra and wings* always wanting.

*Front legs* short, rather stout. Tibia with a triangular process near the apex.

Tarsus two-jointed; second joint with claws inserted about the middle.

*Middle and hind legs* long and slender, inserted at the sides of the posterior end of the thorax; the hind legs inserted above the middle legs. Middle legs with tibia and first joint of tarsus furnished with a fringe of long hairs; tarsus two-jointed, the second joint clawed before the tip. Hind legs with one-jointed tarsus clawed before the tip.

*Abdomen* very short, first three segments covered above by the metanotum.

Apex of the abdomen in the male with a conspicuous rhomboidal appendage.

#### DETAILS OF STRUCTURE.

*Halobates* presents a peculiar appearance on account of the great development of the thorax in comparison with the abdomen, thus approaching in facies the larvæ of some other genera of *Hydrobatina*. The body is covered with very short and close pubescence of a grey colour, which is the predominating tint of the species, few of which have any conspicuous markings, at least on the upper surface. In all there are two reddish or yellowish spots at the back of the head, but in most cases these are not conspicuous. Several of the species have pale markings on the under side.

#### THE HEAD AND ITS APPENDAGES.

*The Head* viewed from above is shortly triangular; viewed from the side, the vertex is more or less convex, while the frons is sloped very much downwards. The vertex is convex, at least in the middle, but is usually widely but shallowly depressed on each side near the hind margin; while there is another more slight depression before the middle lobe of the face. In the female the latter depression is more conspicuous than in the male. The posterior depressions do not extend so far as the orbits, the inner sides of which are slightly tumid. In the posterior depressions is generally a rufous spot, usually ill-defined and not conspicuous, but forming in a few species a conspicuous, oblique, reddish-yellow mark on each side of the middle of the back of the head. The hind margin between the eyes is convexly rounded, and in one or two species the edge is more or less narrowly elevated. The front of the head is sloped downwards, and is nearly, but

not quite, perpendicular. The middle lobe of the face is at least twice as broad as the side lobes, a little dilated at the apex, somewhat prominent and truncate. The side lobes are sub-triangular and rather inconspicuous. The sides of the head are blunt and not margined. On each side of the upper surface of the head are three more or less conspicuous black points, rising above the pubescence, one at the posterior angle near the eye, one situated more inwardly, and in a line with the front of the eyes, and one near the inner angle of the base of the antenniferous tubercles (Pl. III. fig. 7). Under the microscope these spots are seen to be tubercles destitute of the pubescence which covers the rest of the head. The summit of each tubercle is concave with raised margins, and, situated within the rim and to one side, is a smaller tubercle, bearing a short hair (Pl. III. fig. 8). In two species (*wüllerstorffi* and *sericeus*) the apex of these tubercles is from .02 mm. to .022 mm. in diameter, and the length of the hair .06 mm. to .10 mm. On examining one of the tubercles from the inside of the head it appears to be hollow, with the base of the hair protruding (unless this is an optical illusion) for some way into the cavity. It is probable that these tubercles are organs of one of the senses, possibly that of sight. The situation of the posterior ones corresponds with that of the ocelli, with which the Hemiptera are frequently provided, but when these are present in the Heteroptera they are never more than two in number, and true insects in the adult condition have very rarely, if ever, more than three,<sup>1</sup> though there is reason to believe that the anterior ocellus when present really consists of two ocelli coalesced. This anterior pair would correspond to the middle pair in *Halobates*, and the anterior pair (in this genus) has disappeared in other insects (as has in some cases the middle pair, and in others all the pairs), though still existing in some groups of the Arthropoda. The nature of these tubercles seems to have been hitherto overlooked, and it is much to be desired that naturalists who have the opportunity should examine the structure in fresh specimens, and ascertain with what part (if any) of the nervous system they are connected.

*The Eyes* are large and prominent, situated at the hinder angles of the head, and extending for about one-third of their length behind it, resting on the sides of the thorax. The orbit, especially above and below, and in a less degree in front, is provided with several irregular series of long, strong hairs, curved at the tip, the hairs nearest the eye being the largest. Viewed from above, the eye is semi-circular in outline, with the inner edge slightly convex; viewed from the side it is roundly oval; viewed from below the outline is similar to that from above. The facets of the eye are hexagonal. In *wüllerstorffi* their diameter is about .035 mm.; in *sericeus* about .025 mm. The outer free periphery has (in two species) about 25 facets.

*The Antennæ* are attached to the inner anterior apex of conspicuous tubercles, which are situated on the side of the head between the eyes and the apex of the face. These

<sup>1</sup> Some Aphides are said to have six.

tubercles viewed from above are irregularly conical, and connected with the vertex by a tumid ridge, which is more distinct in the female; viewed from below the tubercle points downwards, and the tip extends a little beyond the base of the antenna. Round the insertion of the antenna the tubercle is furnished with a coronet of stiff hairs, curved at the apex. The antennæ themselves are at least half the length of the body, and are four-jointed, with two intermediate jointlets (Pl. III. fig. 1), one between the second and third joints of the antennæ, and one between the third and fourth; in each case the jointlet belongs to the joint preceding it. In one species the jointlets are said, but I think erroneously, to be absent.<sup>1</sup>

The first joint is the longest, and often nearly, and sometimes quite, as long as the other three joints taken together; very narrow at the extreme base, thick above the base, then narrowing to the middle, and often slightly incrassate at the apex; usually slightly curved; covered with numerous semi-adpressed hairs, except at the extreme base; the apex with stronger and longer hairs.

The other joints have similar pubescence to the first, except that the fourth has not stronger hairs at the apex. These joints vary in length and thickness in the various species, but usually the second is gradually incrassate from base to apex; the third is thicker than the second, and often shorter; and the fourth is generally the thickest of all, sometimes incrassate upwards, and sometimes attenuate from the middle upwards. The jointlets have a finer integument (not furnished with pubescence) than the true joints, and are usually of a paler colour than these. That between the second and third joints is narrow at the base and widens to the apex; the other is much smaller, and ring-like. In some species the antennæ are provided with a few fine spines.

The *Rostrum* is four-jointed, and reaches to the front margin of the mesosternum. The labrum is pentagonal, the basal sides oblique, and the apical sides forming a triangle; it reaches to or beyond the apex of the second joint of the rostrum.

The first joint of the rostrum is stout, and broader than long. The second is ring-like, and less than one-half the length of the first. The third is much the longest, stout, widened a little above the base, then diminishing to the apex. The fourth is much shorter than the third, less stout, and triangular in outline. The apex terminates in three short processes, one above and two below (Pl. III. figs. 2 and 3). The upper process (between which and the rest of the joint is a rather ill-defined transverse suture) is the broadest, and is rounded at the end; the two under processes are gradually narrowed to the end, which is gently rounded, their inner margins are sub-parallel, and their tips are shortly longitudinally striate. Between them is the end of the furrow in which the mandibles lie. In a line with the inner edges of the two inferior processes the margins of the furrow for the mandibles are longitudinally thickened, and have in the terminal joint of the rostrum a dark spiral line running round each (Pl. III. fig. 3). This spiral line is not continued into

<sup>1</sup> See the description of *Halobates frauenfeldianus*, *postea*.



the third joint, but in the latter the furrow is finely transversely wrinkled. The integument of the fourth joint has several rows of a few rather stout hairs with tubercled bases.

*The Mandibles* (Pl. III. fig. 4) seem to be triquetrous, with one side broader than either of the other two, and are scarcely dilated at the apex, which is very hard but not extremely finely pointed. On the outer edge, between the narrow sides, is a row of saw-like, back-pointing teeth of unequal length. These teeth gradually increase in length from the apex backwards, the fifth or sixth being the longest; after that they rapidly decrease in length till they become little more than slight elevations of the edge of the mandible. In number they vary in different species, but the average number is probably about twelve. In one species (*wüllerstorffi*) the breadth of the mandible a little behind the apex and across the narrower side is about .012 mm. and on the broader side about .024 mm.; in another species (*sericeus*), the breadths are respectively about .012 mm. and .018 mm. The mandibles can be traced back from the base of the rostrum into the head. On entering the head they suddenly diverge, the space between them being about as broad as the base of the rostrum. They then go nearly straight backwards to a point on a level with the base of the antenniferous tubercles, and are then suddenly bent forwards and outwards, the portion after the abrupt bend being either gradually dilated or split into several portions which diverge a little. This is the appearance presented by specimens mounted in Canada balsam, and lack of material has unfortunately prevented me from attempting to dissect out the parts.

*The Maxillæ* (or the organs which in the Hemiptera are supposed to represent the first pair of maxillæ) are much more complex in structure than the mandibles. Though often, like the mandibles, protruded from the apex of the rostrum, they can be retracted at least so far as that their tips reach only to the apex of the third joint of the rostrum. Though not inseparably united to each other, the two maxillæ are yet for a considerable portion of their length so closely connected that they form but one organ. Moderately magnified and viewed directly from above, this appears to be a rather blunt and stout bristle lying between the mandibles, but when a higher magnifying power is used, the structure is seen to be rather complex. As the specimens which I have examined are mounted in Canada balsam, and all the parts do not lie in the same plane, and as moreover I have not had an opportunity of making transverse sections, the following description (made with the aid of an amplification of 900 diameters), is probably only approximately correct. Viewed from above the organ presents the appearance of four parallel lines, the distance between the inner two being rather greater than between the outer and inner on either side (Pl. III. fig. 5). Towards the apex the outer and inner line on each side approach each other, and form a point which curves rather abruptly inwards, the point on one side overlapping and touching the point on the other, thus forming a rather blunt apex to the organ. On the outer edges, from the tip for a considerable way backwards, are a series of fine, rather irregular hairs, at first directed outwards and a little backwards, and

then bent backwards. Between the outer and inner line on each side, is a series, beginning at the apex, and running back for a considerable way, of somewhat semilunar-shaped tubercles (Pl. III. fig. 6); while between the two inner lines is a close series of fine curved transverse lines, below which may be seen—by altering the focus—another series of similar lines, whose direction from side to side is a little different. If the organ is viewed in profile, the appearance is altogether different, as each maxilla exhibits on one side a series of comb-like teeth, which, beginning at the curved apex, runs back for a considerable way (Pl. III. fig. 6, *a*). What I conceive (perhaps erroneously) to be the real structure of the organ is this. Each maxilla consists of a fine tube, longitudinally open on the inner side and fringed on the outer (from the apex for some distance), with fine back-pointing hairs. The fine curved transverse lines which are seen in the central longitudinal space of the organ are fine curved hairs, which cross from one maxilla to the other, and of which there are on each maxilla a series both above and below (Pl. III. fig. 5, *a*). The semilunar-shaped tubercles are the comb-like teeth viewed directly from above, and which can only be properly made out when the organ is seen partly in profile. On tracing the organ further back, but while it is still included in the rostrum, both the back-pointing lateral hairs and the comb-like teeth disappear, but the inner series of curved hairs are continued. On tracing them backwards into the head the maxillæ can be seen to gradually diverge, and each of them then appears as if finely transversely striate in the middle line. Gradually and slightly dilating, and continuing to diverge, they can be traced backwards into the mesothorax for some distance. The breadth of the maxillæ a little behind the apex is in *sericeus* about .025 mm. and in the larva of *hayanus* about .014 mm.

The under side of the head is flatly convex, with a concave hind margin. The gula is broad, reaching to the hind margin. In form it varies somewhat in different species; sometimes the sides are slightly elevated, and sometimes there is a central longitudinal obtuse keel.

#### THE THORAX.

The thorax constitutes by much the largest part of the body, and increases in width more or less from the front to beyond the middle.

Of the three segments which compose it, two only can be easily distinguished, since the mesothorax and metathorax are coalesced, while the prothorax and mesothorax are quite distinct from each other.

#### *The Prothorax.*

*The Pronotum* is transverse and collar-like, the length in the middle being two to three times less than the breadth, which is less than the head with the eyes. The front margin is usually rather strongly concave between the eyes to receive the head;

the hind margin between the posterior angles is also concave, but often only slightly so, and in every case less concave than the front margin. The sides are a little oblique, so that the pronotum is a little wider behind than in front; gently rounded and convex, with the anterior and posterior angles also rounded. The disk is somewhat convex, or flat, somewhat slightly raised longitudinally in the middle line, or with a finely impressed line there. On each side of the middle line there is frequently a more or less distinct small transverse fovea situated a little behind the front margin; in some cases there is a larger fovea on each side, situated behind the anterior fovea. These foveæ may be of *post-mortem* origin. One species is described as being provided with three longitudinal furrows. Sometimes the pronotum is depressed in the middle of the hind margin. Its shape varies a little in the sexes.

*The Prosternum* is rather shorter than the pronotum, the front margin is less concave, and the hind margin is slightly convex. Of the disk the outer third on each side (except the extreme margin) is occupied from the front to the back by the large swollen acetabula of the front legs. The middle third is more or less strongly elevated on the longitudinal middle line.

The acetabula, viewed from the side, are perpendicular or slightly oblique behind, where they are highest; and from the back to the front present a strongly convex outline. Viewed from the front they are somewhat triangular in outline. The opening of the acetabula looks backwards, and a little inwards, and rests behind against the mesosternum. The anterior rim has a large triangular notch (Pl. I. fig. 8, *ac.*), whose apex reaches to within a short distance of the front margin of the prosternum. From its apex a slit or suture proceeds to, or almost to, the front margin.

#### *The Mesothorax and Metathorax.*

These two segments are coalesced, and together occupy frequently about three-fifths of the entire length of the body. They form also by far the broadest and deepest part. The suture between them is most frequently indicated merely by a sharp short transverse impression (not always to be discerned) situated on each side within, and a little in front of, the ridge leading to the hind legs. Below no part of the metathorax is visible.

*The Mesonotum* is more or less distinctly wider in front than the pronotum. The front margin is convex in the middle, and then concave at each side to receive the posterior angles of the pronotum; the anterior angles are produced a little in a forward direction. The sides are rounded and convex, and the width increases backwards—varying a little according to species and sex—till the greatest width is attained at, or a little before, or a little behind, the middle. The disk is frequently more or less convexly swollen (more rarely nearly flat), and is highest in the middle anteriorly. Sometimes there is a very fine impressed longitudinal central line. Posteriorly the mesonotum with the metanotum slopes more or less rapidly backwards between the insertion of the legs.

The middle and hind legs are inserted together at the sides of the posterior end of the thorax, but the hind legs are inserted above the middle legs, and their acetabula extend a little further back than the middle acetabula (Pl. I. fig. 8, ♂  $\gamma$ ). The middle acetabula, which occupy the lower posterior hind angles of the thorax, are, viewed from the side, cylindrical, and a little broader than long. Above they are covered by the hind acetabula. Viewed from below they are cylindrical, joined on the inner side by the concave hind margin of the mesosternum, which is continued nearly to the apex of each acetabulum. The opening is nearly circular, and looks backwards. On the outer side of the middle line below is a suture or slit of greater or less length.

The hind acetabula occupy the upper posterior angles of the thorax, and are cylindrical, longer than, but not so stout as, the middle acetabula, behind which they extend for about half their length, reaching to the apex of the middle coxæ. The posterior half of the acetabulum is slightly hollowed below, where it impinges on the middle coxa.

Between the middle and hind acetabula is a deep narrow longitudinal furrow, anteriorly forked, the branches being less deeply impressed. The upper branch is the longer, and goes upwards and a little forwards, and marks the base of the acetabulum. The lower and shorter branch runs forwards and a little downwards, and is formed for part of its length by the slit-like opening of the mesothoracic spiracle. In *wüllerstorffi* the slit of this spiracle is about .2 mm. long; and in *sericeus* .16 mm. The opening of the acetabulum is circular, and looks backwards and a little inwards, the free ends of the acetabula being nearer together than their bases.

Lying on the inside of the hind acetabulum is a narrow, almost parallel-sided plate, rather longer than the acetabulum, pointed in front and truncate behind; and divided from the acetabulum on the outer side and from the thorax and abdomen on the inner side by deep narrow furrows. The surface of the plate is not horizontal, but usually slopes more or less steeply to the inside, so that the outer edge is on a level with the upper surface of the hind acetabulum. In some cases, however, the slope is reversed, more especially in gravid females. Posteriorly the plate reaches beyond the end of the hind margin of the thorax, and the transverse impression or suture between the thorax and abdomen is continued across it. The situation of the smaller posterior part of the plate thus marked off varies a little in the sexes, and even in some of the species. In the male it is usually opposite the first free abdominal segment, and more rarely opposite (*e.g.*, in *Halobates sericeus*) the second free segment, which is its usual position in the female. In the latter this part of the plate is also smaller and more detached. Beyond this detached portion traces of similar plates may be seen at the sides of the basal free abdominal segments. It is evident, therefore, that the plate and its continuation are formed by the pleura (or epimera) of the thorax and abdomen. By some writers this plate has been described as the rudiments of the elytra and wings; and as these organs in insects are expansions of the sides or pleura of the thorax, this view is in a limited sense correct. As *Halobates*, however,



has never been found with elytra or wings, and has probably never possessed them, it will, on the whole, be as well not to consider the plates in question to be rudimentary organs.

Between the plates the thorax diminishes in width backwards, and is marked on each side by transverse impressions, deepest at the sides, and rarely going across from one side to the other. These impressions indicate the position of the first three segments of the abdomen, which are covered by the integuments of the thorax.

*The Mesosternum* is more or less flat. The anterior angles are somewhat tumid, and have within them (at least sometimes), a short oblique furrow, in which lies the base of the anterior trochanter. The hind margin is more or less widely and deeply concave. No part of the metathorax is visible below.

#### THE ABDOMEN.

The abdomen, viewed from above, is small, rather depressed posteriorly, and, as regards the portion not concealed by the thorax, sub-triangular in outline, the apex of the triangle having attached to it in the male the conspicuous lozenge-shaped third genital segment, and in the female, being conical. The abdomen rarely reaches backwards much beyond the trochanters of the hind legs.

Including the genital segments, the abdomen consists of nine segments, of which the first three are covered above by the metanotum, and the last three are the genital segments.

#### *The Abdomen of the Male.*

*Dorsal Surface.*—(Pl. I. fig. 8, ♂ β). The hind margins of the first two (covered) segments, when they can be traced across, are rather strongly concave, or even sometimes slightly angulated; the hind margin of the third segment (coinciding with the hind margin of the metanotum) is less concave, or sometimes nearly straight. These three segments are longer in the middle than at the sides. Occasionally the suture between the second and third segments can be traced across the side plate (pleuron) mentioned in the description of the thorax. In most species the division between the third and fourth segments is well defined on this plate.

The fourth segment (the first free one) is usually the longest of the free segments, the remaining two being rather shorter and subequal in length to each other. At the sides of the basal segments there are sometimes slight indications of a connexivum (pleuron), but owing to the position of the abdomen this is very inconspicuous and obscure. The genital segments will be described separately.

*Ventral Surface.*—(Pl. I. fig. 8, ♂ ab. b.). All the six abdominal segments are uncovered. The first five are very short, ring-like, subequal in length, and more or less retracted within each other. The first is more or less covered at the sides by the mesosternum.

On the middle of it is a tubercle whose apex looks backwards and downwards, and is pierced by a somewhat transverse perforation. All the species, and both sexes, are furnished with this tubercle, though in some specimens it is scarcely visible, from the segment being retracted below the mesosternum.

What may be the nature of this tubercle, and its use, must remain uncertain until observations have been made on the living animal. There is nothing, so far as I am aware, corresponding to it in any other true insect. It is possible that its homologies may be found in the "ventral tube" of the Collembola. If such be the case the use may be to secure attachment to the animals on whose juices *Halobates* doubtless feeds, but it is somewhat idle to speculate on the origin and use till actual observations have thrown some light on the nature of the organ. (See note in the Appendix.)

The sixth segment is longer (sometimes much longer) than the others, and the sides are produced obliquely backwards to clasp the sides of the first genital segment. In all the segments the hind margins on the ventral surface are nearer the base of the abdomen than the hind margins on the dorsal surface.

#### *The Abdomen of the Female.*

On the *dorsal surface* it is, on the whole, similar to the male abdomen, with the exception of the differences in the structure of the pleuron mentioned in the description of the thorax.

On the *ventral surface* (Pl. I. fig. 7 ♀ *ab. b.*) all the six segments are ring-like. The sixth is prolonged a little at the sides. The first segment is furnished with a tubercle as in the male.

#### *The Genital Segments of the Male.*

*The First Segment* is, on the dorsal surface, ring-like, and similar to the last abdominal segment, but not so broad. Below it is nearly as long as (or even sometimes longer than) the whole of the abdominal segments taken together, while in shape it is transversely oblong or nearly square.

*The Second Segment* is almost hidden, both above and below, by the first, the only parts usually visible being a small, crescent-shaped, or semilunar plate above, while below all that can be seen is a long horn-like process on each side.

On dissection the true form of the segment is seen to be as follows:—

Above (Pl. III. figs. 20 and 21), transversely oblong, about four times as broad as long; hind margin much prolonged in the middle, the prolongation (the apex of which is the only part visible without dissection) presenting a rounded outline posteriorly.

Below, the middle of the hind margin is concave, giving rise near each side to a long horn-like process which lies along the side of the next segment, and reaches to or beyond

the middle of its length (Pl. III. fig. 22). These processes differ in shape in different species, but deficiency of material to dissect has prevented me from describing them minutely in more than two species (Pl. III. figs. 23 and 24). It may be noted that in one species the left horn is always bent outwards and forwards (Pl. III. fig. 22); in all the other species examined by me both horns are symmetrical. The posterior angles of the segment are in some species furnished with a tubercle-like prolongation; in others this prolongation is situated between the angle and the base of the horn.

*The Third Segment.*—Above, the visible part of this is very conspicuous as an appendage to the end of the abdomen, in outline somewhat like the fluke of an anchor, with the lateral angles more or less produced and the general shape varying according to the species (Pl. III. figs. 20 and 25). The disk is longitudinally convexly elevated from the base (which is sometimes slightly gibbous) to the obtusely conical apex. The sides are somewhat flat, or even slightly depressed. The apex of the segment, viewed from above or from below, looks like an obtusely conical tubercle (Pl. III. figs. 25 and 26; and Pl. I. fig. 1, *g a*), but closer examination shows that the lower half of it is a nearly circular very convex plate, attached by the basal angles to the plate above. Between these plates is a horizontal fissure (at the very apex of the abdomen), in which the intestinal canal opens. The plates are therefore the podical plates. On dissection, the under surface of the upper or lozenge-shaped plate shows a deep longitudinal hollow, in which the intestine lies (Pl. III. fig. 26). The under surface of the extended sides is sometimes armed with short spines.

The third segment below is not continuous at the sides with the third segment above, and in its normal condition (that is, without having been dissected out) appears as a long, oval, convex plate, overlapped at the sides and end by the upper plate, and additionally protected at the sides by the horns of the second segment (Pl. I. fig. 1, *g a*). In some species the margin appears to be a little thickened, and to form a ledge on which the horns rest. On dissection, the plate presents internally (Pl. III. fig. 27) a deep concavity, filled by the horny case which contains the copulatory apparatus. The basal angles are expanded and go upwards and inwards to meet the base of the lozenge-shaped plate whose attachment is between them, the point of attachment being concealed by the produced hind margin of the second segment.

The horny capsule (Pl. III. fig. 28) just referred to is, viewed from above, very convex, rather strongly compressed laterally, and with a very polished surface. Dissected out and viewed from the side, it is seen to be a semicircular case, with the sides somewhat flattened, and the opening on the straighter margin of the semicircle. This straighter margin is not exactly straight, but, so far as the chitinous portion of it is concerned, is for the basal third straight, then widely concave, and then, for about the apical fourth, gently rounded. Along the straight and concave portions of the margin are (in the dissection) the remains of the membrane by which the capsule is attached, the apical fourth being free. It is difficult to make out and to describe the structure of the apparatus contained in the

capsule. From the apex often protrudes a long, very narrow, gradually attenuating process, which, when not protruded, is curled up within the capsule. In *wüllerstorffi* the capsule is about .52 mm. long by .3 mm. broad, and the process, so far as protruded, nearly 1 mm. in length. In *sericeus* the capsule is rather smaller.

### *The Genital Segments of the Female.*

Above and below, three segments are visible.

*The first* is, above, like the preceding abdominal segment, but not so broad. Below it is much longer than it is above, and subequal in length to three or more of the abdominal ventral segments. In shape it is transversely oblong. On the lateral line the dorsal and ventral parts of the plate are posteriorly not continuous for a greater or less length. In dissected examples may be seen a long process (triangular at the base), extending from the front margin forwards within the sixth and fifth abdominal segments.

*The second segment* is, above, similar to the first, but rather shorter and much narrower. Below, it consists of two triangular plates, whose edges meet or overlap in the longitudinal mesial line (Pl. I. fig. 7, ♀ *ab. b.*). (In some cases the first genital segment more or less completely covers the second below.) Within the genital fissure thus formed, but usually quite concealed, is situated the ovipositor, &c. The ovipositor appears to consist of four valves. Two, which lie somewhat externally to the other two, are sublanceolate in shape, with the inner apical margin slightly recurved upwards and outwards, and fringed with long hairs. The two inner valves are rather shorter and narrowly lanceolate, with their inner edges also fringed with long hairs.

*The third segment* terminates the body, and is altogether, in form and structure, like the conical apex of the abdomen of the male.

### THE LEGS.

#### *The Front Legs.*

These are very short in comparison with the others, but are relatively stouter. In addition to subserving locomotion, they are (without being raptorial) fitted for grasping, and, for the greater part of their length, lie well in advance of the body.

*The Acetabula* have been already described.

*The Coxa* (Pl. I. fig. 8, *ac.*) is stout, and for the most part immersed in the acetabulum. It can best be seen on the inner side, where it presents a somewhat triangular outline. In colour it is usually somewhat paler than the rest of the leg.

*The Trochanter* (Pl. I. fig. 8, *ac.*) is large, about twice as long as broad, narrow at the base, and increasing gradually in breadth upwards. It is curved abruptly at the base, and the broad apex is cut obliquely forwards to articulate with the femur.

*The Femur* is joined to the anterior apical face of the trochanter, the base being



curved somewhat downwards and backwards. It is usually stout, but varies in stoutness and shape in different species. The greatest thickness is usually a little above the base, and it is gradually attenuated upwards from about the middle. The anterior edge is nearly straight from the bend at the base to beyond the middle, and thence slightly curved convexly to the apex. The basal half of the posterior edge is either subparallel to the anterior edge or slightly convex, while the apical half is more or less (varying in different species) strongly curved concavely. Near the apex on the posterior edge is a notch, often nearly obsolete, but whose position is then marked in microscopical specimens by a thickening of the integument. The apex itself, which is sometimes very slightly incrassate, presents, when viewed from above (that is, between the anterior and posterior edges), an irregularly oblique outline; nearest the anterior edge it is straight, followed by a semicircular notch, and thence to the hind margin obliquely concave. The femur is more or less pubescent, the hairs on the lower posterior side being more numerous and longer, especially towards the base. The margin of the apex is fringed with long hairs. In most, if not in all the species, the femur is armed with a series of five or more long black hair-like spines, not quite erect, but pointing down the limb, and inserted a little above the posterior edge. The spines are longest and strongest near the base, and the series is not in all cases continued to the apex.

*The Tibia* is usually a little shorter than the femur, and much less stout. For the greater part of its length it is of equal thickness, but the extreme base is narrower, and the apex dilated and bifurcate. The upper branch of the bifurcation is a continuation of the long axis of the tibia, while the lower and posterior branch is subtriangular in outline, the basal side being curved, and the apical side slightly angular and at right angles to the anterior branch. The dilated portion varies in size and shape in different species. On the under side the anterior branch is somewhat flattened, and between it and the posterior branch is an oblique furrow. To the apex of the anterior branch, which is obtusely angular, the tarsus is articulated. On the outer side of the apex of the other branch is an oval patch (varying in size and shape in different species) of peculiar hairs. (Pl. III. figs. 9 and 10). These hairs are very short (in *wüllerstorffi* about .025 mm., and in *sericeus* about .024 mm. long), set so close together that they touch each other at the base and for some distance above it, and are gradually narrowed upwards to the rather blunt apex (Pl. III. fig. 11).

The patch is to be found only in the male; in the female, at the same spot, is a small tuft of short, almost straight hairs, not so closely set together.

The tibia is more or less pubescent, the pubescence being stronger and thicker on the under side of the dilated portion. The tibia is also armed with a series of spines similar to those of the femur, but less strong, and inserted a little below the posterior edge.

*The Tarsus* is two-jointed, and usually a little shorter than the tibia, and rather less stout.

The relative length of the joints one to the other varies in the different species, and often affords a good point of distinction.

The first joint may be equal to, or longer, or shorter than the second. In form it is cylindrical, and the base has a narrow neck. The outer side is clothed with strong hairs, which spring, as in other parts of the leg, from flat circular tubercles. On the inner side some of the hairs are arranged in a regular series, and the general pubescence is finer.

The second joint has also a neck at base, above which it is cylindrical, and with pubescence similar to that of the first joint.

At about the middle of its length the joint is cleft longitudinally into two unequal parts (Pl. III. fig. 13). The upper and outer part (which may be looked upon as the joint itself, while the lower and inner part may be called a process) is twice or three times the length of the other part, but is only about half as thick as the basal half of the joint. On the outer side it is rounded, but on the side facing the process it is flat or slightly channeled, and destitute of pubescence. The hairs on the outer side are rather coarse and adpressed, but towards the apex a few stronger, less adpressed hairs are mixed with the others, and in some species at least two or three long stout hairs, with curved extremities arise some way before the apex, and reach to or beyond it.

The process, or shorter part of the cleft joint, is parallel to the other part. It is somewhat triangular in outline, with a blunt apex, the outer side rounded and clothed with rather long semi-adpressed hairs; the inner face furrowed and destitute of pubescence. The fissure between the two parts is wider on the under side of the joint than on the upper.

At the bottom of the cleft are inserted the two curved sharp pointed claws (Pl. III. fig. 14), which are about double the length of the shorter division or process of the joint. Each claw is rather broad, somewhat angularly keeled on the posterior surface, and slightly concave on the other. At the base it is suddenly dilated posteriorly, the dilatation being triangular in outline. In one species (*wüllerstorffi*) the claws are about .23 mm. long, in another (*sericeus*), they are about .17 mm. From between and a little behind the claws arises a thin ribbon-like process about as long, but only half as broad, as the claws, curved backwards, equally wide and thin throughout, and truncate at the apex (Pl. III. figs. 13 and 14). The use of this process is unknown.

#### *The Middle Legs.*

*The Acetabulum* has been already described.

*The Coxa* is cylindrical, much broader than long; the apex is truncate, and fringed with rather long hairs, which curve inwards; it is hollowed to receive the expanded base of the trochanter.

*The Trochanter* (Pl. III. fig. 15, *tr.*) is about three times as long as broad. Its base is a somewhat flattened ball, which fits into the hollowed apex of the coxa. Above the

base is a very short neck, above which the trochanter suddenly widens, and curves upwards and inwards; it is then for half the length somewhat cylindrical, while the apical half narrows to a point above, and below is triangularly cleft to receive the femur. The trochanter is more or less pubescent, and is sometimes armed on the inner side with small teeth or spines.

*The Femur* (Pl. III. fig. 15, *f.*) is much the longest joint. It is somewhat incrassate at the base, and becomes gradually thinner to about the middle, after which it is for a little way of equal thickness, and then is gradually and slightly incrassated to the apex. It is more or less pubescent, and is usually armed with small spines or teeth pointing backwards, and arranged in a series on the inner side from base to apex; more rarely the spines are irregularly scattered.

*The Tibia* (Pl. III. figs. 15 and 16, *ti.*) is shorter and less stout than the femur, cylindrical, and slightly and gradually attenuate from base to apex. It may be armed like the femur, or be unarmed. On the inner edge is one or more series of flattened circular tubercles, from which arise hairs (usually more or less curved at the apex), increasing in number and length towards the apex of the joint. From out of this line of curved hairs springs a fringe of very long hairs, many times longer than the diameter of the tibia, and naturally straight but easily bent. At the base of the joint these hairs are few, but their number and their length increase towards the apex.

*The Tarsus* (Pl. III. figs. 15 and 16, *ta.*) is two-jointed, the first joint being longer than the second, but varying in its relative length in the different species. The first joint (Pl. III. fig. 16, *ta.* 1) is cylindrical, and a little incrassate at the base. Its inner edge is furnished with hairs similar to those on the inner edge of the tibia; towards the apex of the joint these hairs diminish in length (Pl. III. fig. 17). Approximate measurements of this joint (taken about the middle) give (in *wüllerstorffi*) the diameter of the joint .08 mm.; length of the hairs on the inner side .035 mm.; of the curved short fringe .05 mm.; and of the long fringe .4 mm. In *sericeus* the corresponding measurements are .05 mm.; .025 mm.; .05 mm. and .4 mm. The second joint (Pl. III. figs. 15 and 16, *ta.* 2) is cylindrical, and bears on its inner side a line of short curved hairs, similar to that on the first joint, but without the long hairs. Not far from the apex on the inner side is a notch or excavation, from which to the apex runs a furrow, in which lie two straight claws. Arising from between the claws is a ribbon-like process similar to that on the front tarsus. Between the notch and the apex the joint is thinner than before the notch, and on its outer side arises, some way before the tip, one or two long stout hairs, more or less abruptly bent at the apex, and extending beyond the end of the joint. The length of the claws is, in *wüllerstorffi*, about .085 mm., and of the longest hair on the opposite side of the joint .2 mm. (the ordinary hairs there being .05 mm.). In *sericeus* the claws are .08 mm. long.

*The Hind Legs.*

In general form these resemble the middle legs, but are somewhat shorter and less stout.

*The Acetabulum* has been already described.

*The Coxa* is three or more times as long as broad, slightly curved outwards, and slightly incrassate at the apex.

*The Trochanter* is shorter and thinner than the middle trochanter.

*The Femur* shorter and thinner than the middle femur.

*The Tibia* has not the fringe of hairs on the inner side.

*The Tarsus* (Pl. III. figs. 18 and 19) is one-jointed. The joint is similar to the second joint of the middle legs, but has not the fringe of hairs on the inner side, and the excavation for the claws is rather more distant from the tip. Like the middle tarsus there is, on the side of the joint opposite to the claws, one to three long hairs inserted at different places, and reaching to or beyond the apex of the joint. The ribbon-like process from between the claws is also present. The claws measure in *wüllerstorffi* about .15 mm., and in *sericeus* .12 mm.

## RESPIRATORY SYSTEM.

As in most other insects, air is admitted to the tracheal system by means of spiracles. I have failed to find any trace of prothoracic spiracles. The large mesothoracic spiracles have already been noticed (p. 30). The remaining spiracles are nearly circular in outline, and the first pair of these are inserted near the posterior end of the thorax (though possibly abdominal), and more or less near the sides of the body is one pair, and in the abdomen six pairs can without much difficulty be made out; and possibly others may exist, but may be concealed by the legs. Those that can be seen are as follows:—One pair on the first segment, usually covered by the thorax; one pair on each of the last three segments situated nearer the side of the body than those on the first segment; one pair on the first genital segment; and one pair on the second genital segment, situated at the posterior angles in the male, and about the middle of the side in the female. Measurements of the various circular spiracles give an average of, in *wüllerstorffi*, .035, and in *sericeus*, .025 mm. for the long diameter.

In the last two segments of the larva no spiracles exist.

I regret very much that want of material has prevented me from examining the internal anatomy more completely.



## DESCRIPTION OF THE SPECIES.

The number of species of *Halobates* (in the restricted sense) already described is five, viz. :—

*Halobates micans*, Esch.  
 „ *sericeus*, Esch.  
 „ *flaviventris*, Esch.  
 „ *streetfieldanus*, Templ.  
 „ *wüllerstorffi*, Frauent.

To these I am able to add six, namely :—

|                             |                             |
|-----------------------------|-----------------------------|
| <i>Halobates princeps</i> . | <i>Halobates germanus</i> . |
| „ <i>hayanus</i> .          | „ <i>sobrinus</i> .         |
| „ <i>proceus</i> .          | „ <i>frauenfeldanus</i> .   |

KEY TO THE SPECIES.<sup>1</sup>

- 1 The last three joints of the antennæ of equal length, . . . . . *frauenfeldanus*.  
 The last three joints not all of equal length, . . . . . 2
- 2 Front femora more or less distinctly steel-blue in colour, . . . . . 3  
 Front femora not blue, . . . . . 4
- 3 Antennæ with the second and third joints equally long, . . . . . *micans*.  
 Antennæ with the second joint one-fourth longer than the third joint, . . . *wüllerstorffi*.
- 4 Front tarsus with the first joint nearly twice as long as the second joint, . . . *princeps*.  
 Front tarsus with the first joint never more than equal in length to the second joint, 5
- 5 Antennæ with second joint equal to, or a little longer than, the fourth joint, . . . 6  
 Antennæ with the second joint distinctly shorter than the fourth joint, . . . 8
- 6 Front tarsus with the first joint almost as long as the second, . . . . . *flaviventris*.  
 Front tarsus with the first joint distinctly shorter than the second joint, . . . 7
- 7 Front tarsus with the first joint one-half shorter than the second joint; antennæ  
 with the second and fourth joints subequal in length, . . . . . *hayanus*  
 Front tarsus with the first joint one-third shorter than the second; antennæ with  
 the second joint rather longer than the fourth joint, . . . . . *proceus*.
- 8 Front tarsus with the joints subequal in length, . . . . . *streetfieldanus*.  
 Front tarsus with the first joint shorter than the second joint, . . . . . 9
- 9 Middle tarsus with the first joint seven times longer than the second joint, . . . *sericeus*.  
 Middle tarsus with the first joint not more than five times longer than the second joint, 10
- 10 Base of antennæ narrowly rufous ochreous; front tarsus with first joint a little  
 more than half the length of the second joint, . . . . . *germanus*.  
 Base of antennæ concolourous; front tarsus joint about one-fourth shorter than the  
 second joint, . . . . . *sobrinus*.

<sup>1</sup> The "key" must be used with caution. More than one or two points have to be taken into consideration in discriminating the more closely allied species.

1. *Halobates wüllerstorffi*, Fraenck. (Pl. I. fig. 1).

*Halobates wüllerstorffi*, Fraenck, Verhandl. der. k. k. zool. bot. Gesellschaft in Wien, Band xvii. p. 458, Taf. xii. figs. 1, 2, 6, 8, and 10, 1867.

Oval, widest behind the middle. Whitish ash grey, paler on the sides and below. Back of the head with two very indistinct reddish spots. First two joints of the antennæ (indistinctly), coxæ, trochanters, and femora, and in a less degree the tibiæ more or less shining steely blue. Second joint of antennæ nearly one-fourth shorter than the fourth, and about one-fourth longer than the third. Front tarsus with first joint rather shorter than the second. Middle tarsus first joint more than three and a half times the length of the second.

♂. Length 4·25, breadth 2·3, middle femur 5, hind femur 3·25 mm.

♀. Length 3·5, breadth 2·5, middle femur 4, hind femur 2·5 mm.

*Habitat*.—The most widely diffused of all the species, but most common in the North Atlantic, between the tropic of Cancer and the equator. Less common in the North Atlantic, north of the tropics; in the South Atlantic, within the tropics; in the Indian Ocean; in the North-West Pacific, at about lat. 10° N., and in the South Pacific at about the tropic. There are no records of its occurrence in the Eastern Pacific.

In the Atlantic specimens have been taken between about lat. 43° N. and 20° S. In the Pacific between about lat. 10° N. and 25° S. In the Pacific specimens have not been taken east of long. 175° E.

The following are the localities of the specimens seen by me:—

*Challenger Specimens.*

North Atlantic, localities:—Station 98, Aug. 14, 1873, lat. 9° 21' N., long. 18° 28' W.; between Teneriffe and St. Thomas, West Indies, February and March 1873; about lat. 18° N., long. 28° W., April 28, 1876; Station 62, June 18, 1873, lat. 35° 7' N., long. 52° 32' W.

South Atlantic:—Off Rio de Janeiro, June 18, 1873.

North Pacific:—North of the Admiralty Islands, March 1875 (about lat. 12° N., long. 142° E.).

*Specimens from other Sources.*

North Atlantic localities:—Cape Finisterre (*Oxford Museum*); lat. 10° N. (*Stockholm Museum*); lat. 9° 20' N.—5° N., long. 26° 30' W.—26° 50' W. (*Liverpool Museum*); Sargasso Sea (*Liverpool Museum*); lat. 5° N., long. 25° W. (*Liverpool Museum*); lat. 2° 30' N., long. 28° 30' W., January 31, 1865 (*Liverpool Museum*); Atlantic near equator (*Stockholm Museum*).

South Atlantic localities:—Near St. Helena (*Berlin Museum*); South Atlantic (*Liverpool Museum*).

Indian Ocean localities :—Just south of Mauritius, lat.  $25^{\circ}$  S. (*Collingwood*) ; Sunda Straits (*Turin Museum*) ; lat.  $2^{\circ}$  S., long.  $84^{\circ} 20'$  E. (*Westwood*).

Pacific localities :—Near Norfolk Island (*Berlin Museum*) ; Guinea (*Signoret*).

$\text{\textit{\textbf{♂}}}$ . Oval, widest before the middle (Pl. I. fig. 1  $\text{\textit{\textbf{♂}}}$ ). Whitish ash grey, paler on the sides and below ; sometimes with slightly brassy reflections. The two reddish spots at the back of the head more or less ill-defined. Eyes dark brown. Rostrum shining black, apex fulvous brown. Claws of the legs fulvous brown. Antennæ black, with, especially on the last two joints, greyish pubescence ; the first two joints with an indistinct bluish tinge. Legs black ; coxæ, trochanters, and femora, especially of the middle and hind legs, and in a less degree the tibiæ, more or less shining steel-blue. Front legs with grey hairs, the other legs with black or dark grey hairs. Underside of abdomen towards the middle at the sides more or less indistinctly reddish ochreous. Genital segments more or less shining bluish-black, but usually covered with greyish pubescence which is easily denuded.

*Head* rather strongly convex, slightly elevated on the mesial longitudinal line. *Antennæ* (Pl. I. fig. 1, *a.*) three-fifths the length of the body ; first joint rather shorter than the other three taken together, slightly curved, very slightly thinner upwards, and apex slightly incrassate ; second joint almost one-third the length of the first, slender, thinnest in the middle, then slightly incrassate to apex ; third joint rather stout, cylindrical, thickest towards the apex, about three-fourths the length of the second ; fourth joint nearly one-fourth longer than the second, thickest at the base, then gradually and slightly attenuate upwards.

*Pronotum* with front and hind margins nearly equally concave ; disk slightly convex, with two transverse foveæ on each side, of which the posterior are the largest. *Mesonotum* widest about the middle, disk very convex.

*Front Legs*: Femora stout, thickest near the base, thence equally thick to the middle, and then slightly and gradually attenuate to the apex ; slightly notched on the inner side just before the apex. The usual hairlike spines are frequently absent. Tibia nearly four-fifths the length of the femur, apex strongly dilated. Tarsus (Pl. I. fig. 1, *f.t.*) about four-fifths the length of the tibia ; second joint longer than the first, cleft about the middle.

*Middle Legs*: Femora about one-eighth shorter than the tibia and tarsus taken together ; scarcely incrassate at the apex, and rarely and obscurely armed with spines. Tibia (Pl. I. fig. 1, *m.t.*) rather more than one-half the length of the femur, rarely and obscurely armed. Tarsus subequal to, or slightly shorter than, the tibia, the first joint more than three and a half times the length of the second.

*Hind Legs*: Femur subequal in length to the tibia and tarsus taken together, rarely and obscurely armed with spines. Tibia about one-fourth shorter than the femur. Tarsus more than one-fourth the length of the tibia, cleft at about two-thirds the length from the base.

*Abdomen*: Sixth ventral segment nearly as long as the other five, the disk rather flatly depressed posteriorly.

*Genital Segments*: ♂ First below nearly as long as all the abdominal segments taken together, nearly as long as broad, hind margin straight, posterior angles rounded. Second below only visible at the sides; the right horn reaching nearly to the apex of the next segment (below); the left horn bent just above the base, and directed outwards and a little upwards (Pl. III. fig. 22). The horns (Pl. III. fig. 23) have thickened margins; the outer margin and the surface generally are covered with slight tubercles tipped with hairs; the apical margin is smooth; the inner is fringed at the base with long hairs, and from near the base to the apex is armed with tubercle-like teeth, arranged in several series on the thickened part, and pointing downwards. The hairs on the surface also point downwards. The posterior angles of this segment are prolonged into a broad tubercle-like process. The third segment above (Pl. I. fig. 1 *g*, and 1 *ga*) has the lateral angles somewhat produced.<sup>1</sup> The third segment below has apparently thickened margins.

♀. (Pl. I. fig. 1, ♀.) Similar in appearance to the male, but differs in the following particulars:—

Form more widely oval; femora of front legs and first joint of antennæ more distinctly steel-blue. Front femora less stout. Hind margins of ventral segments and apex of third genital segment indistinctly brownish-red. Below, the first genital segment about covers the second.

*Halobates wüllerstorffi* has been found from January to April, from June to August, and in October, and the larvæ from January to April, so that it probably occurs throughout the whole year.

The only note that I can find regarding the life history is in Dr. Cuthbert Collingwood's *Rambles of a Naturalist*, p. 358. The specimens referred to were given by him to Mr. J. W. Douglas, and by Mr. Douglas to me, and appertain to this species. "A notable circumstance occurred in the Indian Ocean, in lat. 25° S., just south of the Mauritius. For several days in succession the net produced *Halobates*, glass-crabs, *Velella*, and the beautiful oceanic shell *Janthina*, of a rich deep violet colour." A footnote is added as follows:—"The occurrence of this singular Hemipterous insect at sea is at least very remarkable. There appear to be several species, of which I met with two, one on the coast of China, and the other some 500 miles from the land, in the South Indian Ocean. That they are veritable marine insects I think cannot admit of a doubt, though how they exist in the open ocean is a mystery. They are of a deep bluish-black, with six legs, the two hindmost furnished with a delicate brush on the inner side of the tarsus. The abdomen is remarkably undeveloped. Although taken occasionally in the

<sup>1</sup> For the form of this segment in the present and succeeding species, the student is referred to the figures, which will give a much better idea of the shape than any description could do.



towing-net, I did not find them common, and never observed any movement after capture, owing to their delicate soft bodies being injured by the passage of water and other things through the net."

2. *Halobates micans*, Esch. (Pl. I. fig. 2).

*Halobates micans*, Esch., Entomographien, i. p. 107, No. 78*b*, Taf. ii. fig. 3, 1822.

Burmeister, Handbuch der Entomologie, vol. ii. p. 208, No. 1, 1835.

Blanchard, Hist. Natur. des Insectes, vol. iii. p. 98, No. 1, 1840.

Herrich-Schäffer, Die wanzenartigen Insecten, vol. viii. p. 110, 1848.

Frauenfeld, Verhandl. der k. k. zool. bot. Gesellsch. in Wien, p. 458, Taf. xii. fig. 5, 1867.

Widely oval, widest behind the middle. Hoary ash grey, lighter below. Antennæ and legs black, front femora bluish. Antennæ with second and third joints equal in length.

♀. Length 4, breadth 2·25, middle femur 4·6 mm.

*Habitat*.—Reported by Eschscholtz from the South Pacific and South Atlantic Oceans, and by Frauenfeld from the Indian Ocean, near Ceylon (lat. 3° N.).

I have not seen this species, and the above diagnosis and the following description are drawn up from the writings of Eschscholtz and Frauenfeld. Both these writers say that they have seen males only, but they confused the sexes—Eschscholtz's figure representing a female.

♀. Closely allied to *Halobates wüllerstorffi*. Widely oval or conical. Hoary ash grey or blackish-grey, somewhat shining, brighter coloured below. With (according to Eschscholtz) brassy reflections, which, however, Frauenfeld denies. Eyes black. Antennæ and legs black, the front femora bluish. Abdomen whitish-grey. Antennæ (Pl. I. fig. 2, *a.*) rather slender, rather longer than half the body, first joint as long as the other three together; second and third equal in length; fourth joint longer than the third. Pronotum strongly concave in front, nearly straight behind; disk with two rather long foveæ anteriorly. Mesonotum strongly convex anteriorly.

According to Frauenfeld, *micans* differs from *wüllerstorffi* in the slenderer antennæ, with longer first joint, and second and third joints equal in length; legs more slender, and, except the front femora, without any bluish tinge.

Dr. Rogenhofer kindly measured, at my request, some of Frauenfeld's specimens in the Vienna Museum, and states the proportions of the joints of the tarsi to be as follows:—First joint of front tarsus very little shorter than the second joint; middle tarsus one-sixth shorter than the middle tibia; first joint of middle tarsus less than three times the length of the second.

As Frauenfeld was acquainted with both species, there can be no doubt that *micans* exists as a species distinct from *wüllerstorffi*, but whether all the specimens that

Eschscholtz saw, and on the strength of which he gives as localities the South Atlantic and South Pacific Oceans, are really referable to *micans*, seems to me open to doubt.

3. *Halobates princeps*, n. sp. (Pl. I. fig. 3).

Oblong oval, widest behind the middle. Somewhat shining, silvery ash grey, especially on the sides and below. A reddish-yellow oblique mark on each side of the head posteriorly. Middle acetabula, with the inferior margins, inner edge of suture, and the adjacent part of the hind margin of mesosternum, as well as the hind margins of the ventral segments, fuscous ochreous. Antennæ and front legs black. Middle and hind legs brownish-black. Antennæ with second joint subequal in length to fourth, less than twice as long as third. Front tarsus with first joint a little less than twice as long as second. Middle tarsus with first joint more than three and a half times the length of second.

♀. Length 5.5, breadth 2.3, middle femur 7, hind femur 5 mm.

*Habitat*.—Celebes Sea. February 6th, 1875. One specimen. (Challenger.)

Somewhat like *Halobates wüllerstorffi*, but distinguished from that and other species by its larger size and longer middle and hind legs, as well as by the long first joint of the middle tarsus.

♀. Oblong oval, widest behind the middle. Slightly shining silvery ash grey, brighter at the sides and below. Back of the head with an oblique, not very well-defined reddish-yellow spot on each side. Antennæ and front legs black, with greyish pubescence. The other legs brownish-black; coxæ and trochanters with silvery grey hairs, the other joints with fuscous hairs. Eyes brown. Rostrum black. Margins of the middle acetabula below, the adjacent part of the hind margin of the mesosternum, the inner edge of the middle acetabular suture, and the hind margins of the ventral abdominal segments fuscous ochreous.

*Antennæ* (Pl. I. fig. 3, *a.*) about three-fourths the length of the body; first joint slender, subequal in length to the other three joints taken together; second joint slender, about one-third the length of the first; third joint more than one-half the length of the second; fourth subequal in length to second, stout and slightly attenuate upwards.

*Pronotum* with front margin strongly and hind margin slightly concave; disk with a wide transverse fovea on each side anteriorly.

*Mesonotum* widest behind the middle.

*Front legs* with stout femora, thickest about the middle; tibia subequal in length to femur; tarsus (Pl. I. fig. 3, *f.t.*) subequal in length to the tibia, first joint a little less than twice as long as the second, which is cleft between the base and the middle.

*Middle legs*: trochanter armed with spines; femora as long as the tibia and tarsus taken together, armed with very fine spines; tibia more than one-half the length of the femur, the basal one-third armed with fine spines; tarsus (Pl. I. fig. 3, *m.t.*) one-fifth shorter than the tibia, first joint more than three and a half times the length of the second.

*Hind legs*: femur, about two-thirds the length of the middle femur, one-fifth longer than the tibia and tarsus taken together, armed with fine spines; tibia about half as long as the femur, armed with fine spines; tarsus about five-eighths of the length of the tibia, cleft a little beyond the middle.

*Abdomen*: fourth dorsal segment with two obscure short transverse impressions on each side of the middle.

*Genital segments*: first below longer than all the ventral abdominal segments taken together, strongly transversely convex, hind margin straight. Second segment below concealed by the first.

4. *Halobates streatfieldanus*, Templn. (Pl. I. fig. 4).

*Halobates streatfieldana*, Templeton, Trans. Entom. Soc. of London, vol. i. p. 230, pl. xxii. fig. A, 1836.

Broadly ovate, widest behind the middle. Brilliant black above, brownish-black below. Two small spots at the back of the head, and the sides and hind margins of the fourth and fifth abdominal segments above rufous. Abdomen below with the first five segments yellowish, with hind margins rufous. Antennæ: second joint longer than the third, but shorter than the fourth. Front tarsus with the joints subequal in length.

♀. Length, 0·13 inch (3·3 mm.).

*Habitat*.—Atlantic Ocean, nearly midway between Africa and America south of the equator.

I have not seen this species. The above diagnosis and the following description are compiled from Templeton's paper.

♀. Broadly ovate or lozenge-shaped. Brilliant black above, brownish-black below; sides when dry somewhat hoary. Head with a rufous spot on each side of the middle at the hind margin. Eyes rufous. Abdomen above with the sides and hind margins of the fourth and fifth segments rufous; below with the first five segments yellowish, with rufous hind margins.

*Antennæ* (Pl. I. fig. 4, *a.*) about two-thirds the length of the body; first joint slender, not so long as the other three taken together; second longer than the third; fourth longer than the second, attenuating upwards.

*Pronotum* gently channeled into three subequal divisions, scarcely visible in the dried specimen.

*Front legs* (Pl. I. fig. 4, *f.l.*) : tarsus (Pl. I. fig. 4, *f.t.*) with the joints subequal, the second cleft about the middle.

Templeton's full description, as also the account of the capture of the specimen, will be found in the first part of this paper.

5. *Halobates sobrinus*, n. sp. (Pl. I. fig. 5).

Long oval, widest behind middle (♂), or oval, widest about the middle (♀). Ashy grey (♂), or dark grey (♀), paler below. Head with two ill-defined rufous spots posteriorly. Antennæ and legs dull fuscous black. Abdomen : hind margin of fourth dorsal segment rusty brown, genital segments dull fuscous black (♂); or ventral segments dull brownish, hind margins broadly ochreous, first and second genital segments brownish below, middle acetabula below from the suture inwardly rather broadly ochreous (♀). Antennæ : third joint rather more than one-fourth shorter than the second, which is one-fourth shorter than the fourth. Front tarsus : first joint about one-quarter of the length shorter than the second. Middle tarsus : second joint rather more than one-quarter of the length of first.

♂. Length 4, breadth 1.75, middle femur 5, hind femur 4.5 mm.

♀. Length 4, breadth 2, middle femur 4, hind femur 3 mm.

*Habitat*.—Tahiti (*Stockholm Museum*).

♂. Long oval, widest behind the middle. Ashy grey, somewhat paler below. Head with the usual ill-defined rufous spots. Antennæ, legs, first genital segment below, and genital segments above, dull fuscous black, with more or less sparse grey pubescence.

*Head* with the hind margin very slightly elevated on each side of the middle. *Antennæ* (Pl. I. fig. 5, *a.*) about three-fifths the length of the body; first joint shorter than the other three taken together; second joint about one-half the length of the first; third about three-quarters the length of the second; fourth about one-quarter longer than the second, attenuate from the middle upwards.

*Pronotum* : front margin rather strongly concave, hind margin slightly concave; disk slightly convex, with a very fine impressed longitudinal central line, on each side of which is an anterior transverse fovea. *Mesonotum* gradually widened to beyond middle, disk convex, with a very fine percurrent longitudinal central line.

*Front legs* : femora rather stout; tibia subequal in length to femur; tarsus (Pl. I. fig. 5, *f.t.*) about two-thirds as long as tibia, first joint about one-fourth shorter than the second, which is cleft before the middle.



*Middle legs*: femur subequal in length to tibia and tarsus together, armed with a series of small teeth, as is the tibia; tibia about three-fourths of the femur in length; tarsus (Pl. I. fig. 5, *m.t.*) about three-fourths of the tibia in length, second joint rather longer than one-fourth of the first, cleft near apex.

*Hind legs*: femur and tibia armed like the middle legs, the femur about one-third longer than the tibia and tarsus taken together; tarsus about one-third the length of the tibia, cleft beyond the middle.

*Abdomen* (which appears to be a little distorted—in drying—in the specimen described) with the sixth ventral segment a little longer than the fifth.

*Genital segments*: first below subequal in length to all the abdominal ventral segments, hind margin very slightly concave, sides oblique. Second segment with horns reaching nearly to the apex of third below: exterior to the base of each horn is a spine-like tubercle. Third segment (Pl. I. fig. 5, *g.*) above with the lateral angles much produced outwardly.

♀. Oval, broadest about the middle. Darker in colour than the male; middle acetabula below, from the suture inwardly, rather broadly ochreous, shading into brown. Abdomen above with the hind margins of the uncovered segments, especially the fourth and fifth, rusty brown (possibly, however, this is the membrane between the segments, more visible than usual); ventral segments (2nd to 6th) dull brown, with the hind margins broadly ochreous. Genital segments: first fuscous brown; second below brown; third below black.

*Head* more convex than in male, the hind margin not elevated. *Antennæ* with the fourth joint quite as long as half the first, and about one-fourth longer than the second.

*Abdomen*: hind margins of ventral segments rather elevated and thickened.

It is not improbable that fresher examples of this species may be greyer in general colour.

## 6. *Halobates sericeus*, Esch. (Pl. I. fig. 7).

*Halobates sericeus*, Esch., Entomographien, i. p. 108, No. 79, Taf. ii. fig. 4, 1822.

Burmeister, Handb. d. Entomol., ii. p. 209, No. 2, 1835.

Blanchard, Hist. Nat., vol. iii. p. 98, No. 2, 1840.

Amyot and Serville, Hémipt., p. 412, No. 2, 1843.

Herrich-Schäffer, Die wanzenartigen Insecten, vol. viii. p. 110, Tab. cclxxxvi. fig. 880 ♀, 881 ♂, 1848.

Ovate, widest a little before (♂) or about (♀) the middle. Ashy grey. Head with the usual ill-defined reddish marks at the hind margin. Antennæ, legs, rostrum at base, and genital segments, fuscous black, clothed more or less with grey pubescence. Hind margins of the ventral abdominal segments sometimes obscurely luteous. Antennæ: third joint

shorter than the second; fourth subequal in length to the second and third taken together. Front tarsus with first joint less than one-half (two-fifths) the length of the second. Middle tarsus with first joint seven times longer than the second.

♂. Length 3, breadth 1.75, middle femur 3.25, hind femur 2.5 mm.

♀. Length 3, breadth 2, middle femur 3, hind femur 2.25 mm.

*Habitat*.—Next to *Halobates wüllerstorffi*, the most abundant species, but almost confined to the North Pacific Ocean, over which, within or near the tropics, it is widely diffused. Less abundant in the South Pacific. Two specimens, which seem inseparable from *sericeus*, were taken by the Challenger in the North Atlantic, near the Cape de Verde Islands. Amyot and Serville record its occurrence near the Cape of Good Hope, and Fairmaire from near Madagascar; but I have not seen specimens from either locality, and it is possible that these were not correctly determined, since any small grey *Halobates* was always referred to *sericeus*.

The specimens I have examined are from the following sources:—

#### *Challenger Specimens.*

North Pacific localities:—Many stations on the voyage from the Admiralty Islands to Japan, and from Japan to Honolulu (or—in other words—common between the equator and lat. 38° N., and between long. 137° E. and 154° W., thus ranging considerably north of the tropics).

South Pacific:—Lat. 23° 46' S., and long. 149° 59' W.

North Atlantic:—About lat. 11° N., long. 32° W.

#### *Specimens from other Sources.*

Pacific between Cape Horn and San Francisco (*Liverpool Museum*). “Ocean Austral” (*Berlin Museum*). “Pacific.—Lat. 24°–34°, long. 120°–115°” (*Stockholm Museum*).

♂. Ovate, widest a little before the middle. Ashy grey. Antennæ, rostrum, legs, and genital segments fuscous black, clothed more or less with grey pubescence. Head with an ill-defined reddish oblong transverse blotch on each side at the hind margin. Eyes brown or, more rarely, yellowish. Rostrum for apical half, front femora, and last genital segment below more or less shining black. Abdomen with the ventral hind margins sometimes very obscurely reddish luteous.

*Antennæ* (Pl. I. fig. 7, *a.*) comparatively stout, about half as long as the body; first joint more than one-third shorter than the other three joints taken together; second incrassate upwards, about two-fifths the length of first; third cylindrical, shorter than the second; fourth stout, slightly and gradually incrassate upwards, subequal in length to the second and third taken together.

*Pronotum* of the usual form, disk somewhat flat, rather hollowed in the middle posteriorly, and with a transverse fovea on each side anteriorly. *Mesonotum* widest a little behind the front margin, disk very convex. *Mesosternum* with a very indistinct percurrent longitudinal mesial line.

*Front legs*: femora very stout (comparatively), nearly equally thick to middle, then narrowing to apex; tibia about four-fifths the length of the femur; tarsus (Pl. I. fig. 7, *f.t.*) about three-fifths the length of the tibia, first joint two-fifths the length of the second, which is cleft about the middle.

*Middle legs*: trochanters armed on inner side with short spines, as is the femur; femur rather shorter than the tibia and tarsus taken together; tibia a little shorter than the tarsus; tarsus (Pl. I. fig. 7, *m.t.*) first joint seven times as long as second joint.

*Hind legs*: femur armed as middle femur, about one-fifth longer than the tibia and tarsus together; tibia armed on all sides with scattered small spines; tarsus cleft at about two-thirds of the length.

*Abdomen*: peculiarities of the connexivum have been noticed in the generic description.

*Genital segments*: first below as long as four of the abdominal ventral segments, transversely convex, sides parallel. Second with the horns reaching about three-fourths the length of the third below; the margins of the horn (Pl. III. fig. 24) are not thickened, and on the basal half are a few long hairs pointing inwards, and arising from the disk; apical half of the disk set with short, stout, outward-pointing teeth; near the base of the horn, and between it and the posterior angle of the segment, is a tubercle. Third segment above (Pl. I. fig. 7, *g.*), with the lateral angles moderately produced; on each side below is a patch of sharp spines pointing forwards.

♀. Ovate, widest at about the middle. Hind margins of the ventral abdominal segments sometimes luteous.

*Head* and *mesothorax* more convex than in the male.

*Front tibia* nearly as long as femur.

*Middle legs*: trochanters unarmed, femora less strongly armed. Sometimes the middle and hind legs are scarcely armed.

*Abdomen* below (Pl. I. fig. 7, ♀ *ab. b.*): segments 1st to 5th, each rather elevated in transverse middle line; sixth with a suboblique transverse furrow not quite reaching the middle.

*Genital segments*: first below as long as three of the ventral abdominal segments together, transversely convex, sides tumid, hind margin straight in the middle, each side somewhat oblique.

*Halobates sericeus* has been found in March, April, June, July, and October, but pro-

bably occurs all the year round. The larva resembles the adult, with the exception of the differences to be noted in the description of the metamorphoses.

7. *Halebates germanus*, n. sp. (Pl. I. fig. 6).

Long oval (♂) or shortly ovate (♀), widest behind the middle. Dark ashy grey paler on the sides (♂), or silvery ashy grey (♀). Head with an obscure transverse rufous yellow mark on each side at the hind margin. Antennæ and legs fuscous black above, dark fuscous brown below, clothed sparsely with grey pubescence. Base of antennæ narrowly rufous ochreous. Front legs with coxæ, trochanters more especially on inner side, and base of femora below; middle legs with a spot on the acetabula below (broader and more distinct in the female) trochanters, and base of femora below; hind legs with trochanters and base of femora, more or less indistinctly fuscous ochreous brown. Abdomen with hind margins of ventral segments fuscous ochreous. Genital segments: first below on disk and posteriorly, second above, and apex of third above, fuscous brown; second below, especially at apex of horns, and most of third below, fuscous rufous brown. Antennæ: third joint shorter and fourth joint longer than the second. Front tarsus: first joint rather more than half the length of second. Middle tarsus: first joint about five times as long as second.

♂. Length 3.5, breadth 2, middle femur 4, hind femur (?) mm.

♀. Length 3, breadth 2.25, middle femur 4, hind femur 3 mm.

*Habitat*.—North Pacific Ocean and Celebes Sea (Challenger); China Sea (Giglioli).

♂. Long oval, widest behind the middle. Dark ashy grey, paler on the sides. Antennæ and legs fuscous black above, dark fuscous brown below, more or less sparsely clothed with grey pubescence. Rostrum with the apical three-fourths shining black. Eyes dark brown. Antennæ at the extreme base rufous ochreous. Head with an ill-defined transverse rufous yellow mark on each side near the hind margin. Front legs with the coxæ, trochanters (more especially on the inner side) and base of femora; middle legs with a blotch on under side of acetabula, trochanters, and femora at base below; hind legs with trochanters and base of femora, more or less indistinctly fuscous ochreous brown. Abdomen with the hind margins of the ventral segments fuscous ochreous. Genital segments with the second above and apex of the third above, as well as the disk and hinder part of the first below, fuscous brown; the second below, especially at the tips of the horns, and the third below, especially towards the base, fuscous rufous brown.

*Head* with hind margin slightly elevated on each side of the middle, the elevation neither reaching the middle nor the eyes. *Antennæ* (Pl. I. fig. 6, *a.*) more than half



the length of the body, rather slender; first joint rather more than three-fourths of the length of the other three together; second joint less than one-half the length of the first; third one-fourth shorter than the second; fourth nearly one-quarter longer than the second, slightly attenuate from the middle upwards.

*Pronotum* of usual shape with the usual anterior foveæ, disk rather flat. *Mesonotum* widest behind the middle, disk convex.

*Front legs*: femur rather stout, equally thick to beyond middle; tibia about one-fifth shorter than femur; tarsus (Pl. I. fig. 6, *f.t.*), more than one-half length of tibia, first joint rather more than half (nearly five-eighths) the length of the second, which is cleft about the middle.

*Middle legs*: trochanters and femora armed with short teeth; femur rather shorter than tibia and tarsus together; tibia about one-fifth longer than tarsus; tarsus (Pl. I. fig. 6, *m.t.*) second joint about one-fifth the length of the first joint.

*Hind legs* (from the ♀): trochanters and femora with fine teeth; femur about two-fifths longer than the tibia and tarsus together; tibia four and a half or five times longer than the tarsus; tarsus cleft a little beyond the middle.

*Abdomen*: sixth ventral segment a little longer than the fifth.

*Genital segments* (Pl. I. fig. 6, *g.*): first below nearly as long as all the ventral abdominal segments together; disk sloping forwards anteriorly, posteriorly flat, with an oblique-sided hollow (from shrinking in drying?), hind margin straight. Second below with horns reaching four-fifths the length of the third below and with a tubercle near the base of each.

♀. Shortly ovate, widest behind the middle. Silvery ashy grey. Coxæ, trochanters, and base of femora below paler than in the male. Middle acetabula below more widely and distinctly ochreous or rufo-ochreous, which colour spreads to the adjoining part of the hind margin of the mesosternum. First genital segment paler below.

*Head* more convex.

*Pronotum* more convex in middle, with two transverse foveæ on each side, the anterior larger and deeper.

First *genital segment* below almost as long as all the ventral abdominal segments together, tumidly convex in centre posteriorly, hind margin narrowly straight in middle, the sides somewhat obliquely rounded at the base.

This species might readily be mistaken for *sericeus*, from which, however, it seems to be structurally distinct. I have seen only three specimens (unfortunately not in the best condition) from the following sources:—

Celebes Sea, February 6 and 7, 1875, and between the Admiralty Islands and Japan, March and April, 1875 (Challenger); “Mare della China” (Turin Museum).

One specimen shows a curious abnormality of the right antenna (the left is broken),

which is only two-jointed, the first joint very small and almost ring-like, the second about as long as the normal fourth joint.

8. *Halobates hayanus*, n. sp. (Pl. I. fig. 8).

Oval, widest about (♂) or behind (♀) the middle. Silvery grey above, paler on the sides, and silvery white below. Antennæ and legs blackish, with grey pubescence. Head with an oblique, wedge-shaped, reddish-yellow spot on each side between the eyes, the spots meeting by their narrower ends at the middle of the hind margin.

♂. Antennæ at the base, prosternum (except the sides), front legs with coxæ and trochanters, a spot at base and a smaller spot at apex of front femora; middle and hind legs with under side of coxæ and trochanters, sternum with a somewhat obsolete longitudinal posterior central line, a large triangular blotch on the under side of the middle acetabula, a large spot on the outer side of all the acetabula, third genital segment above with the margins, as well as the abdomen and genital segments below, more or less yellowish ochreous. Second genital segment above reddish-brown, tips of the horns blackish-brown. Antennæ: third joint about four-fifths the length of the second, fourth joint subequal in length to the second. Front tarsus: first joint about one-half the length of the second. Middle tarsus: first joint quite three times the length of the second.

♀. Similar in colour to the male, but front femora with a yellow-ochreous band above from base to near apex, and another more distinct one on the inner under side. Under side of the body mostly yellowish ochreous, sides of the head, and sides of the sternum, especially anteriorly and on the front margin of the mesosternum, fuscous brown.

♂. Length 3.5, breadth 1.5, middle femur 4, hind femur 3.5 mm.

♀. Length 3.5, breadth 2.25, middle femur 4.5, hind femur 3.5 mm.

*Habitat*.—Red Sea, near Aden (Dr. George Hay).

♂. Oval, widest behind the middle. Silvery grey above, more silvery on the sides, and silvery white below. Antennæ and legs fuscous black, with grey pubescence. Head with two oblique transverse, wedge-shaped reddish-yellow spots, which meet by their narrow ends at the middle of the hind margin. Sides of the head with longer silvery white pubescence. Jointlet between the second and third joints of the antennæ reddish-yellow. Antennæ with the base; prosternum except the sides; front legs with the coxæ and trochanters, and a spot at base and a smaller spot at apex of femora; middle and hind legs with under sides of coxæ and trochanters; mesosternum with a rather obsolete posterior central longitudinal line, and a large triangular blotch reaching from the apex of the middle acetabula nearly half-way to the front margin of the mesosternum; all the

acetabula with a large spot exteriorly; third genital segment above with the margins, as well as the abdomen below and genital segments below, more or less yellowish ochreous, tinged in some places with reddish. Pale markings of the trochanters and coxæ with small black or fuscous spots and blotches varying in intensity of colour. Eyes brownish-black; rostrum piceous black. Tubercle at the base of the abdomen fuscous black. Front tarsus fuscous brown. Second genital segment above reddish-brown, the tips of the horns blackish-brown.

*Head* very convex in middle of vertex. *Antennæ* (Pl. I. fig. 8, *a.*) more than three-fourths the length of the body, rather slender; first joint subequal in length to the other three together; second rather more than one-third (about two-fifths) the length of first; third thicker than the second, and about one-fifth shorter; fourth joint subequal in length to the second, rather incrassate upwards to near the tip, then attenuate; several of the joints have a few spines.

*Pronotum* of usual form, rather flat, with an anterior transverse fovea on each side. *Mesonotum* gradually widened to the middle, then gradually narrowing; disk convex, with a very faint impressed longitudinal central line.

*Front legs*: femora rather stout, equally thick to middle; tibia about three-fourths the length of the femur; tarsus (Pl. I. fig. 8, *f.t.*) about three-fourths the length of tibia, first joint rather stout, about one-half the length of the second, which is cleft at the middle.

*Middle legs*: femur armed on inner side with fine spines, about one-third shorter than the tibia and tarsus taken together; tibia about three-fourths the length of the femur; tarsus (Pl. I. fig. 8, *m.t.*) rather more than one-fourth shorter than the tibia, first joint quite three times the length of the second.

*Hind legs*: femur about one-fourth longer than the tibia and tarsus together; tibia nearly four times as long as the tarsus, armed with fine spines; tarsus cleft beyond the middle.

*Abdomen* (Pl. I. fig. 8, ♂ *ab.b.*): first ventral segment rather the longest, the hind margins of the second to the fifth slightly produced in the centre; sixth nearly concealed in the middle by the fifth.

*Genital segments* (Pl. I. fig. 8, *g.*): first below nearly as long as all the ventral abdominal ones together, hind margin concave, sides oblique. Second with horns reaching nearly to apex of the third segment below, with a small conical tubercle near the base of each.

♀. Ovate, widest behind the middle. Colour and markings as in the male, but the front femora have a yellow ochreous band above from the base to near the apex, and another more distinct one on the under inner side. Sometimes the whole femur below, except at the apex and most of the first joint of the antennæ below, is more or less pale, but this may be from immaturity. Head with the sides and sternum on the sides, especially anteriorly, as well as the front margin of the mesosternum, fuscous brown.

*Front femora* less stout than in the male.

*Genital segments*: first below longer than all the ventral abdominal segments together, hind margin concave, posterior angles obliquely rounded. Second below with the edges of the valves overlapping each other a little.

The larva is similar to the adult (with the usual differences), but with the bases of the front femora and antennæ, as well as the under side of the body more widely pale, and the leathery parts of the integuments above reddish-brown. The species occurs in large "schools" on the surface of the sea near Aden, and the larvæ, which seem to dislike the wind more than the adults, take shelter in the lee of piers.

9. *Halobates proavus*, n. sp. (Pl. II. fig. 1).

Oblong, rather wider behind the middle. Slaty grey above and below. Head with an oblique transverse reddish-yellow spot on each side, nearly forming a band on the hind margin. Antennæ and legs fuscous brown. Gula, front acetabula at the margins, and front coxæ at the apex; most of middle coxæ; sternum posteriorly, at least sometimes; a large triangular brown-edged blotch on the under outer side of the middle acetabula, and the adjacent hind margin of mesosternum, as well as the greater part of the abdomen below, yellow ochreous. Abdomen with first and second ventral segments in part, the sixth at the sides, a spot at the base on each side of the first genital below, and the tips of the horns of the second genital, more or less fuscous brown. Trochanters at the apex, front femora with a long streak on the under side, middle femora with a spot at the base below, as well as sometimes the disk posteriorly of the mesosternum, brownish ochreous. Antennæ: third joint about two-thirds the length of the second, fourth joint subequal in length to second. Front tarsus: first joint nearly two-thirds the length of the second.

♂. Length 4, breadth 1.5, middle femur 4.25 mm.

*Habitat*.—Gilolo (British Museum and Brussels Museum).

♂. Oblong, rather wider behind the middle. Slaty grey above and below. Head with an oblique transverse reddish-yellow spot on each side at the hind margin, nearly forming a band there. Antennæ and legs fuscous brown. Eyes reddish-brown. Rostrum shining black. Gula, sternum posteriorly, at least sometimes, margins of front acetabula and apex of front coxæ, a large triangular brown-edged spot on the under and outer side of the middle acetabula, and the hind margin of mesosternum adjacent thereto, most of the middle coxæ, and most of the abdomen below, as well as genital segments below, yellowish ochreous. Abdomen with the first and second ventral segments in part, the sides of the sixth, a spot at the base of the first genital segment below, and the tips



of the horns of the second genital segment, more or less fuscous brown. Front femora with a long streak on the under side, the trochanters at their apex, a spot at the base of the middle femora, as well as sometimes the disk posteriorly of the mesosternum, brownish ochreous.

*Antennae* (Pl. II. fig. 1, *a.*) slender, about three-fourths the length of the body; first joint shorter (about one-sixth) than the other three together; second less than half the length of the first; third about two-thirds the length of the second; fourth slightly shorter than the second, stouter, attenuate from the middle upwards.

*Pronotum* with an impressed longitudinal central line. *Mesonotum* slightly and gradually widening to about the middle, disk rather flat, with a fine impressed longitudinal percurrent central line.

*Front legs*: femora not very stout, thickened about the middle; tibia about four-fifths the length of the femur; tarsus (Pl. II. fig. 1, *f.t.*), about half as long as the tibia, first joint nearly two-thirds the length of the second, second cleft before the middle.

*Middle legs*: trochanter armed with spines; femur with scattered spines all round, shorter than the tibia and tarsus taken together; tibia about four-fifths the length of the femur, with a series of spines on the inner side; tarsus (Pl. II. fig. 1, *m.t.*) about two-thirds the length of the tibia, first joint three times the length of the second.

*Hind legs*: femur about two-fifths longer than tibia and tarsus together.

*Abdomen*: sixth ventral rather longer than any of the preceding segments, hind margin straight, with a narrow transverse depression.

*Genital segments*: first below, about as long as any three ventral segments, except the sixth, hind margin straight, sides oblique; second with horns reaching nearly to apex of third below; third (Pl. II. fig. 1, *g.*) above with the lateral angles rounded.

Closely resembling *Halobates haydens*, but differs, *inter alia*, by the greater length of the first joint of front tarsus, more spiny middle femora, more strongly impressed line on the thorax, &c. I have seen the male only.

10. *Halobates flaviventris*, Esch. (Pl. II. fig. 2).

*Halobates flaviventris*, Esch., Entomographien, i. p. 109, No. 80, Taf. ii. fig. 5, 1822.

„ „ Burmeister, Handb. d. Entom., vol. ii. p. 209, No. 3, 1835.

„ „ Herrich-Schäffer, Die wanzenartigen Insecten, vol. viii. p. 110, 1848.

Oblong, widest in the middle. Slaty grey, silvery white on the sides and below. Head with an oblique transverse reddish-yellow mark (nearly joining at the middle of the hind margin) on each side posteriorly. Antennae and legs brownish-black. Front acetabula with outer rim very narrowly; a long triangular blotch in front of the middle acetabula below; hind acetabula with a spot on the outer side; abdomen below (except the sides narrowly); genital segments, disk of the first below and under side of the horns

of the second, ochreous yellow. Third genital segment above and below brownish-black, the disk of the third below and apex reddish-yellow. Antennæ: third joint about two-thirds the length of the second, fourth a little shorter than the second. Front tarsus: first joint about one-fifth shorter than the second, which is cleft before the middle. Middle tarsus: first joint two and one-half times the length of the second.

♂. Length 5, breadth 2, middle femur 6, hind femur 4.5 mm.

*Habitat*.—North Atlantic, near St. Helena (*Berlin Museum*). Indian Ocean, near Ceylon (*Oxford Museum*). Eschscholtz gives the South Atlantic as the locality of his specimens, and Fairmaire determined some of Coquerel's *Halobates* taken near Madagascar as belonging to this species.

♂. Oblong, widest in the middle, then becoming slightly and gradually narrower to each end. Greyish-black in old examples (when fresh "blue-grey, as if covered with bloom"), silvery white on the sides and below. As in the allied species, the usual red spots on the head are very distinct, oblique and transverse, and nearly meet at the middle of the hind margin. Antennæ and legs brownish or fuscous black. Rostrum shining black. Eyes dark brown. Outer rim of the front acetabula very narrowly, a long triangular black-edged blotch on, and extending in front of, the middle acetabula below, a spot on the outer side of the hind acetabula, the ventral segments of the abdomen (except at the sides, especially of the sixth), the disk of the first genital below, and the under side of the horns of the second genital, ochreous yellow. The third genital segment above brownish-black; third below brownish-black, with the disk and apex reddish-yellow.

*Head* moderately convex, the edge of the hind margin distinctly elevated, except near the eyes. *Antennæ* (Pl. II. fig. 2, *a.*) slender, about one-half the length of the body; first joint subequal in length to the three others taken together; second about one-third the length of the first; third about two-thirds the length of the second; fourth subequal to the second, cylindrical, slightly attenuate upwards.

*Pronotum* of the usual shape, disk nearly flat, slightly longitudinally convex in middle, with a very slight hollow on each side of the middle. *Mesonotum* slightly widened to the middle, disk rather flat.

*Front legs*: femora moderately thick, thickest a little above base; tibia about four-fifths the length of the femur; tarsus (Pl. II. fig. 2, *f.t.*) more than one-half the length of the tibia, first joint about one-fifth shorter than the second, which is cleft before the middle.

*Middle legs*: femur shorter than the tibia and tarsus taken together, armed with fine spines; tibia three-fourths the length of the femur, armed like the femur; tarsus (Pl. II. fig. 2, *m.t.*) about one-half the length of the tibia, first joint about two and one-half times the length of the second.

*Hind legs*: femur not quite twice as long as the tibia and tarsus together, armed

below with fine spines; tibia with spines all round; tarsus less than one-fourth the length of tibia, cleft at about two-thirds of the length.

*Abdomen*: sixth ventral segment a little longer than the preceding ones, hind margin straight.

*Genital segments*: first below as long as all the ventral abdominal segments together, disk slightly convex, hind margin straight, sides oblique; second with horns reaching three-fourths the length of the third below; near the base of each horn, and exterior to it, is a conspicuous obtuse tubercle. Third above (Pl. II. fig. 2, *g.*) with the lateral angles acuminate produced.

This seems to be a scarce species. Eschscholtz saw the male only (which he calls the female). I have seen two specimens, both males. The female has not been discovered. The Oxford Museum specimen was captured on September 12, 1834.

#### 11. *Halobates frauenfeldianus* (Pl. II. fig. 3).

*Halobates flaviventris*, Frauenfeld (*nec* Eschscholtz), Verhandl. der k. k. zool.-bot. Gesellsch. in Wien, vol. xvii. p. 459, Taf. xii. figs. 3, 4, 7, and 9, 1867.

Oval, widest behind the middle (♀). Pale hoary ash grey above. Head with a brownish-yellow spot on each side posteriorly, united to a narrow line of the same colour on the hind margin. Antennæ with the basal halves of the joints; prosternum; mesosternum with a central longitudinal line broadest behind and narrower in front (absent in the ♂); ventral segments of the abdomen; a spot near the insertion of each of the legs; the front femora below, and a more or less extensive spot at the base above, as well as the under side of the coxæ of the middle and hind legs, yellow. Front femora black above. Antennæ: second, third, and fourth joints equal in length. Front tarsus with first joint about one-third shorter than the second joint. Middle tarsus with first joint two and one-half times the length of the second.

♂. Length 4.1, breadth 1.9, middle femur 5.1 mm.

♀. Length 4.2, breadth 2.4, middle femur 5 mm.

*Habitat*.—Indian Ocean near the Nicobar Islands (Frauenfeld).

I have not seen this species, and have compiled the diagnosis and description from Frauenfeld's paper. The latter author's description is a little confusing, as he sometimes uses the sign ♂ (both in the text and in the plate) when he evidently intended to write ♀. He has made the same mistake as to the sex as Eschscholtz and other writers have done. Moreover, he gives two different measurements for the female (his male). Frauenfeld's description applies chiefly to the female, for, as he thought, the male had already been described by Eschscholtz. I am indebted to Dr. Rogenhofer for measurements of the front and middle tarsi of specimens in the Vienna Museum.

Oval, widest behind the middle (♀), pale hoary ash grey above; the usual spots at the back of the head distinct, brownish-yellow, and united to a narrow line of the same colour on the hind margin. Front femora, middle and hind legs black. Eyes clear, or brown. Antennæ with the basal halves of the joints, the prosternum, a central longitudinal line (in the female) wide posteriorly and narrowed anteriorly on the mesosternum, the ventral abdominal segments, a spot near the insertion of the legs, the front femora below and more or less extensively at the base above, as well as all the coxæ below, yellow.

*Antennæ* (Pl. II. fig. 3, *a.*) about as long as three-fourths of the body, slender; first joint shorter than the other three taken together; the second, third, and fourth of equal length.

*Front femora* stout; front tarsus with the first joint about two-thirds the length of the second.

*Middle legs*: tibia about one-third longer than the tarsus; tarsus first joint two and one-half times the length of the second.

The larva has the plates hoary ash grey, the leathery part of the integuments brown, the sides, under side, &c., yellow.

Frauenfeld lays much stress upon the absence of a jointlet between the second and third joints of the antennæ. I have not seen adult specimens, but find that in the larvæ (some of Frauenfeld's own specimens, lent me by the Vienna Museum) this jointlet does exist, and therefore, judging from what is the case in other species, suspect that it is also present in the adult.

#### HALOBATODES, n. g.

*Body* oval or oblong.

*Head* (with eyes) semicircular.

*Antennæ* four-jointed, with two intermediate jointlets.

*Rostrum* four-jointed, first and second joints very short, the latter ring-like; third joint the longest.

*Eyes* large, situated at the back of the head and resting partly on the pronotum.

*Ocelli*, none.

*Prothorax*, transverse, much broader than long, distinct from the mesothorax.

*Mesothorax and metathorax* together cylindrical, coalesced, the boundary between them scarcely distinguishable; no scutellum nor scutellar process.

*Elytra and wings* wanting.

*Front legs* short, rather stout; tibia with a straight or nearly straight process at the apex. Tarsus two-jointed, first joint very small, second joint with claws inserted beyond or about the middle.



*Middle and hind legs* long and slender, inserted at the sides of the posterior end of the thorax, the hind legs inserted above the middle legs. Middle legs without a fringe of long hairs. Tarsus two-jointed, second joint clawed before the tip. Hind legs with two-jointed tarsus, the second joint clawed before the tip.

*Abdomen* short; sides furnished with a conspicuous connexivum. Apex of the abdomen in the male without a conspicuous rhomboidal appendage.

Type of genus: *Halobates lituratus*, Stål.

In general form resembling *Halobates*, but with a different facies, and easily distinguished by the shape and structure of the head and front tibia, the two-jointed hind tarsus, differently constructed abdomen and genital segments, and much less pubescent integuments, as well as by the more variegated coloration.

#### DETAILS OF STRUCTURE.

##### THE HEAD AND ITS APPENDAGES.

*The Head* (with the eyes) presents, when viewed from above, a somewhat semicircular outline. Without the eyes it is oblong, the front and hind margins slightly rounded, and the sides slightly concave. The vertex is more or less convex; the face perpendicular; the middle lobe larger than the side lobes, widest at the apex, which is truncate; and the side lobes triangular. The *Eyes*, viewed from above, are subtriangular in outline, with the outer margin rounded; the inner margin nearly straight; and the hind margin concave, resting on the sides of the pronotum. Seen from below, the eye is subtriangular in outline. There are no ocelli nor ocellus-like spots.

*The Antennæ* (Pl. II. figs. 4 *a.*, 5 *a.*, 6 *a.*) are four-jointed, the first joint being the longest, slightly curved, and usually thinnest in the middle. The second joint is slightly incrassate upwards, and between the second and third joints is a distinct jointlet. Between the third and fourth is also a minute jointlet. The fourth joint is usually fusiform. The antenniferous tubercles are situated between and close to the eyes and side lobes of the face, and form cups to receive the antennæ, the inner side of the rim being incised as in *Halobates*.

*The Rostrum* reaches to the front margin of the mesosternum, and is four-jointed. The first joint is stout, and about as broad as long. The second is ring-like; the third is the longest; and the fourth is shorter than the third, and thinner.

## THE THORAX.

As in *Halobates*, the thorax forms by far the largest part of the body, and increases in width more or less from the front to beyond the middle. In a similar manner two only of the three segments which compose it can be made out, the posterior two being coalesced.

*The Prothorax* is much broader than long, and narrower than the head with the eyes. The Pronotum has the front margin concave between the eyes, then obliquely rounded to the posterior angles; the anterior angles excavated to receive the eyes; the sides rounded and convex; the posterior margin slightly concave; and the disk rather flat. The Prosternum is in the middle third rather flat or longitudinally convex, and the outer third on each side is occupied by the large acetabula.

*The Mesonotum* is a little wider in front than the prothorax, and widens gradually backwards; the front margin is slightly convex in the middle, and then slopes slightly concavely forwards; the sides are rounded and convex; and the disk is also convex. The Mesosternum has the disk rather flat, anteriorly sloping to the prosternum.

Between the *mesonotum* and *metanotum* no suture is apparent. The metanotum slopes backwards between the ridges leading to the hind legs. No part of the meta-thorax is visible below. The hind margin of the *mesosternum* is widely concave.

## THE ABDOMEN.

The structure of the abdomen is rather difficult to make out as regards the exact point above where the thorax ends and the abdomen begins, or whether any of the abdominal segments are covered by the integuments of the thorax.

*The Abdomen of the Male.*

On the dorsal surface in the male (Pl. II. fig. 4 ♂ *ab. a.*, 6 ♂ *ab. a.*) one segment appears to be covered, as its front margin is obscure. The front margin of the second segment is angulated, the hind margin slightly concave, and the length in the middle is three times the length at the sides. The third to the sixth segments have nearly straight hind margins, the third segment being the longest of these. All the segments have a conspicuous connexivum, which is erect, and perpendicular to the segments. It is widest opposite the third segment, and thence decreases in width anteriorly and posteriorly. The abdomen itself slopes backwards to the end of the fourth segment, and is then sub-horizontal. Below, the male abdomen (Pl. II. fig. 4 ♂ *ab. b.*, 6 ♂ *ab. b.*) is convex, with six ring-like segments, whose hind margins are concave. The first segment has the sides mostly hidden by the mesosternum, and has in the middle a conspicuous perforated tubercle as in *Halobates*.

*The Abdomen of the Female.*

The abdomen of the female (Pl. II. fig. 4 ♀ *ab. a.*, 4 ♀ *ab. b.*, 5 ♀ *ab. b.*) is on the whole similar to that of the male.

*The Genital Segments of the Male.*

*The first segment* above is similar to the sixth abdominal segment, but narrower and longer; like it it is provided with an erect connexivum. Below it is ring-like, but nearly as long as all the ventral abdominal segments together; the hind margin is concave.

*The second* is, below, longer than the first, the hind margin concave, the sides prolonged and sloping upwards and backwards to the upper surface, where they form a convex oblong plate (with hairy margins) nearly concealing the third above.

*The third* below is a convex roundish plate; above is a small conical tubercle like the podical plates in *Halobates*, nearly concealed, and embraced by the third segment below. There is therefore reason to believe that the third segment above and the third below are not to be considered as the same segment. I have had no opportunity of making dissections.

*The Genital Segments of the Female.*

Three segments are visible above, but only one below. The first and second above resemble the sixth abdominal above, but are somewhat shorter and narrower. The third above is a conical tubercle.

The only segment visible below is triangularly convex, with the apex truncate, the sides sloping upwards and embracing the sides of the three segments above, forming, as it were, a continuation of the erect connexivum of the abdominal segments.

## THE LEGS.

*The Front Legs.*

As in *Halobates*, these are very short in comparison with the others, and for the greater part of their length lie well in advance of the body.

*The Acetabulum* (Pl. II. fig. 5, *ac.*) is very large, occupying the outer third on each side of the prosternum, and extending from the front to the hind margin. Its opening is circular, and looks backwards and downwards; on the middle line in front is a suture or slit reaching from the rim to the base, but not triangularly emarginate as in *Halobates*.

*The Cora* is nearly altogether immersed in the acetabulum, appearing merely as a ring above the opening.

*The Trochanter* is large ; viewed from the inner side it is subtriangular, and attached to the coxa by a small narrow neck at the anterior lower angle ; viewed from the outer side it is subrhomboidal, with the femur inserted on the upper anterior side.

*The Femur* (Pl. II. fig. 4 ♂ *f.l.*, 4 ♀ *f.l.*, 6 *f.l.*) is moderately stout, and varies somewhat in shape in different species and sexes.

*The Tibia* (Pl. II. fig. 4 ♂ *f.l.*, 4 ♀ *f.l.*, 6 *f.l.*) is nearly as long as the femur, and slightly incrassate from base to apex. Above it is crossed near the apex by a furrow running obliquely towards the base from the hind to the front margin. The hind margin itself is prolonged into a short nearly straight process which extends a little beyond the apex.

*The Tarsus* (Pl. II. fig. 4 ♂ *f.l.*, 4 ♀ *f.l.*, 6 *f.l.*) is attached to the anterior part of the apex of the tibia, and is two-jointed, with the first joint very small. The second joint is fusiform, and cleft and clawed beyond the middle, the claws being furnished with the ribbon-like process already described in *Halobates*.

#### *The Middle Legs.*

These limbs are inserted at the lower posterior angles of the thorax.

*The Acetabulum* is large and cylindrical, with the opening slightly oblique and circular. The middle line below has a long longitudinal suture or slit.

*The Coxa* is ring-like, and much broader than long.

*The Trochanter* has a ball-like base lying in the hollowed apex of the coxa ; viewed from the inside it is lanceolate, attached by a slightly curved neck to the ball-like base.

*The Femur* is inserted on the under side of the trochanter, and gradually narrows from the base to about the middle, being very slightly incrassate at the apex.

*The Tibia* gradually narrows from the base to before the middle, and has somewhat longer hairs on the inner side, but is not furnished with a long fringe as in *Halobates*.

*The Tarsus* (Pl. II. fig. 5, *m.t.*) is two-jointed. The first joint is rather thicker at the base, where also it has longer hairs (but not a long fringe) on the inner side. The second joint is cleft and clawed near the tip, and furnished on the outer side with one or two long hairs, as in *Halobates*.

#### *The Hind Legs.*

These are inserted above the middle legs at the upper posterior angles of the thorax.

*The Acetabulum* is large and cylindrical. Each slightly approaches the other posteriorly, and the opening is slightly oblique and circular. Viewed from the side, the acetabulum shows an impression on the under side for about half of its length posteriorly, in which impression the middle coxa lies. Between the hind and middle acetabula is a



deep narrow furrow, anteriorly forked, the upper branch nearly perpendicular, but sloping slightly forwards; the lower and shorter branch horizontal, and occupied for all or most of its length by the longitudinal opening of the mesothoracic spiracle. On the inner side the acetabulum is bounded by the erect connexivum, which at its commencement has its edge slightly but acutely folded over to the outer side.

*The Coxa* is similar to the middle coxa, but rather longer.

*The Trochanter* is similar to the middle trochanter.

*The Femur* is also similar to the middle femur, and nearly as long or longer, but less stout.

*The Tibia* is similar to the middle tibia, but without longer hairs on the inner side.

*The Tarsus* (Pl. II. fig. 5, *h.t.*) is two-jointed, with the second joint cleft and clawed before the apex.

#### DESCRIPTION OF THE SPECIES.

In the following pages four species of *Halobatodes* are described, namely :—

*Halobatodes lituratus*, Stål.

„ *histrío*, n. sp.

„ *compar*, n. sp.

„ *stålí*, Dohrn.

Of these the first three are before me, and are certainly congeneric. The fourth, which was described as *Halobates stålí*, I have not seen, and as the original description does not give any of the details of structure, it is perhaps not rightly located in this genus. From the description of the coloration, however, it seems to be probably a *Halobatodes*.

#### KEY TO THE SPECIES.

Owing to insufficiency of material, colour differences have to be employed in the following key (as well as in the diagnoses of the species) more than structural differences.

- |                                                                                |   |   |                    |
|--------------------------------------------------------------------------------|---|---|--------------------|
| 1. Ground colour yellow testaceous; markings black or brownish-black,          | . | . | 2                  |
| Ground colour dull black; markings yellow testaceous,                          | . | . | 3                  |
| 2. The central longitudinal black line of the thorax continued to the abdomen, |   |   | <i>lituratus</i> . |
| The central longitudinal black line of the thorax not reaching the abdomen,    |   |   | <i>histrío</i> .   |
| 3. Under side of body dull black,                                              | . | . | <i>compar</i> .    |
| Under side of body yellow testaceous,                                          | . | . | <i>stålí</i> .     |

1. *Halobatodes lituratus*, Stål (Pl. II. fig. 4).*Halobates lituratus*, Stål, Öfv. af K. Vet.-Ak. Förhandl., p. 238, 1854.

" " Stål, Eugenes Resa. Insekter, p. 264, 124, 1858.

" " Mayr, Novara-Expedition Zool., Bd. ii. p. 177, 1866.

Ovate, widest behind the middle. Dirty yellowish testaceous, with sparse fuscous pubescence. Head, thorax, and abdomen above with brown or blackish-brown lines and spots, of which the central longitudinal line of the thorax reaches the abdomen. Dirty ochreous below. Genital segment below of the female, with a notch at the middle of the sides.

♂. Length 6, breadth 2.5, middle femur 6.5, hind femur 6 mm.

♀. Length 4.5, breadth 2.5 mm.

*Habitat*.—The Chinese Seas. I have only seen two specimens, one from the Stockholm Museum, the other from Dr. Signoret's collection, and received by him from Stål. Unfortunately the male is not perfect, and so the following description is not so complete as it might be.

♂. Ovate, widest behind the middle. Dirty yellowish testaceous, with sparse fuscous pubescence. Head with an obscure double mark between the eyes; clypeus towards the apex, and a triangular spot at base of the rostrum; antenniferous tubercles; pronotum with a short line on each side; mesonotum with a large oblique spot on each side of the centre, brown or fuscous brown. Pronotum with the front margin and a central longitudinal line; mesonotum with middle of front margin, a central percurrent longitudinal line, a short rather indistinct line on each side of the central line, and joining the oblique brown spot; a short line leaving front margin on a level with the eyes; a transverse line (wider exteriorly) crossing the central line posteriorly, in front of which a large spot (united to the central line by a slender line) gives rise to an oblique line running forwards and outwards, and forming (about the middle of the side) a loop from which it runs irregularly back along the side to the base of the middle legs, the ends of the above mentioned transverse line turned forwards, and meeting or nearly meeting the looped line, as well as a longitudinal line on the sides abbreviated at each end; sternum with a short slightly oblique streak on each side, more or less brownish or fuscous black. Abdomen above blackish, with pale golden pubescence, and a more or less wide transverse band on each segment yellowish testaceous. Last genital segment yellowish testaceous, fuscous black at base and apex. Under side of thorax and abdomen dirty ochreous. Rostrum ochreous, apex of the third and all of the fourth joint shining piceous black. Legs yellowish testaceous, with fuscous pubescence. Front legs with a small spot on outside of coxæ, femora with the base exteriorly very narrowly, a wide streak on the outer side not reaching base or apex, a shorter streak on the inner side, which reaches (by a prolongation below) the apex, as well as the apex itself, piceous black; tibia and

tarsus fuscous black. Middle legs: upper margin of acetabula, a streak on the outer side of coxæ, femora with two spots at the base and the apex, fuscous black; tibiæ brownish, with black hairs, apex fuscous. Hind legs: upper rim of acetabula, and a streak in front, coxæ with a longitudinal streak continued on to the trochanters, femora with the base, an exterior spot near it and the apex, fuscous black; tibiæ and tarsi fuscous brown with black hairs.

*Head* moderately convex above, rather strongly convex in front. Rostrum: third joint about three times as long as the first and second together; fourth about one-third the length of third.

*Front legs* (Pl. II. fig. 4 ♂ *f.l.*): femora stout, slightly curved, tapering towards base and apex, posterior side with a rounded blunt tubercle at about the middle, a slight notch near the apex, and a small tubercle between the notch and the apex; apex fringed with strong hairs. Tibia as long as femur; tarsus more than one-third the length of the tibia.

*Middle legs*: femur rather stout, unarmed; tibia about one-fifth shorter than the femur, armed below with a few fine spines.

*Hind legs*: femur very slightly shorter than the middle femur; tibia about two-thirds the length of the femur, armed below with fine spines; tarsus about one-fifth the length of the tibia, joints subequal in length, the second cleft about the middle.

*Abdomen* (Pl. II. fig. 4 ♂ *ab. a.*, and 4 ♂ *ab. b.*): sixth segment below nearly as long as all the other ventral segments taken together, hind margin concave, fringed, slightly emarginate in the middle.

*Genital segments*: above one is visible, about as long as broad, very convex, hind margin angularly emarginate. Below, the first, which is part of the first above, is nearly as long in the middle as all the ventral abdominal segments taken together, hind margin concave, sides sloping backwards and upwards. The second segment below is a very convex plate surrounded by the first segment; hind margin rounded, and forming with the hind margin of the first above a crescent-shaped aperture at the end of the body.

♀. Widely ovate, widening to the middle, then parallel-sided. Colours brighter and markings more distinct than in the male. Head with a large blackish spot, prolonged anteriorly, between the eyes; clypeus and antenniferous tubercles more suffused. Pronotum more strongly marked, and with a large brown spot joined to the front margin on each side of the middle line. Mesenotum much more distinctly marked: front margin narrowly blackish-brown; a central longitudinal line widening backwards, and widest behind the middle; on each side of central line a slender line, first going slightly obliquely outwards, forming an angle and running sharply obliquely inwards, and having from the angle to the end a large reddish-brown oblong blotch joined to it; more external to the last-mentioned line a slender line, curved inwards and nearly reaching the oblong blotch external to the latter line, another starting from the front margin below the level of the eye, runs along the side of the base of the middle legs; from the base of the middle legs another

line runs forward along the side to about the middle, forms a loop upwards and backwards, and joins an oval blotch on the disk behind the reddish-brown blotch; from the oval blotch a short straight line joins the longitudinal central line at right angles; more posteriorly to this another transverse line crosses the longitudinal line and connects the anterior ends of the connexivum, and from each end a slender curved line runs forwards and outwards to the looped line. The above-mentioned markings are black or fuscous black. Abdomen more or less black, posterior segments with the angles of the connexivum, and genital segments with the centres, dirty testaceous. Antennæ (which are broken in the male) yellowish testaceous, gradually suffused upwards with fuscous brown, more especially on the under and outer side; second and third joints fuscous brown, the jointlet reddish-brown, fourth joint dirty testaceous suffused with fuscous. Front legs less strongly marked than in the male.

*Antennæ* (Pl. II. fig. 4 *a.*) (broken in the male) about three-fourths the length of the body; first joint slender, furnished at the upper and inner side with fine rather long spine-like hairs; second joint about half as long as the first, also with spine-like hairs; third joint subequal in length to second, but more slender; fourth about three-fourths the length of third, and slightly thicker.

*Front legs* (Pl. II. fig. 4 ♀ *f.l.*) not so stout as in the male; femur without the central tubercle, and with the notch at apex sub-obsolete, armed below with a few long hair-like spines.

*Abdomen* (Pl. II. fig. 4 ♀ *ab. a.*, and 4 ♀ *ab. b.*): sixth segment below as long as the two preceding segments, sides a little produced.

*Genital segments*: two visible above; first ring-like and resembling the last abdominal segment; second small, transversely convex, broader than long, hind margin straight. One visible below, longer than all the abdominal ventral segments taken together, convex, triangular, apex slightly concave; at the middle of each side with a notch from which a fold curves inwards and then forwards. The side margins, which are continuous with the connexivum, embrace the sides of the two segments above.

## 2. *Halobatodes histrio*, n. sp. (Pl. II. fig. 5).

*Halobates histrio*, De Haan, MS.

Widely ovate, widest about the middle, then parallel-sided. Dull yellowish testaceous above, with black or brownish-black lines and spots, of which the central longitudinal line on the thorax does not reach the abdomen. Dirty ochreous below. Genital segment below of the female without a notch at the middle of the sides.

♀. Length 6, breadth 3.5, middle femur 6.5, hind femur 6.5 mm.

*Habitat*.—Japan (*Berlin Museum*).

Very similar to *Halobatodes lituratus* in form and colour, but differs in its rather larger



size, in the somewhat different arrangement of the markings, and in the form of the genital segment below of the female. I have seen two females only, and possibly the male may show greater differences than the female does.

♀. Widely ovate, widening to the middle, then parallel-sided. Dull yellowish testaceous, with very sparse fuscous pubescence. Markings black or brownish-black, as follows:—Head with an oblong mark between the eyes, slightly split behind and united to a line on the inner side of each orbit by a short slender line. Pronotum: front margin broadly between the eyes, joined on each side to a short thick line running backwards and then curved outwards; a small spot behind each eye, and a percurrent central line tapering to a sharp point on the hind margin. Mesonotum: front margin between the shoulders; a central percurrent line not reaching the abdomen; a thick short line on each side of the centre; a slender short line curved inwards from each shoulder; a slender line on the side not reaching the base or apex; on the disk an obliquely transverse line with curved ends embracing the short thick line, and sometimes joining the slender curved line that rises from the front margin; posterior to this a blotch on each side, united by a straight transverse line to the central longitudinal line, gives rise to a line which, running outwards and forwards, is looped backwards and divides, one branch going to the connexivum, the other to near the base of the middle legs; a short thick line in front of the hind legs but reaching the rim of the acetabulum. The anterior ends of the connexivum joined by a broad transverse line in which the central longitudinal line ends; posterior to this another transverse line.

Clypeus and apex of antenniferous tubercles fuscous. Eyes black. Antennæ fuscous brown, first joint ochreous at base above and for a little way beyond base below; joint-let reddish-brown. Rostrum pale ochreous with a brown spot at the base, apex of the third and all of the fourth joint shining black. Front legs: outer side of acetabula with a pale brown small spot; coxæ pale ochreous with a blackish spot near the apex; trochanters pale ochreous, with a few blackish spots at the apex; femora ochreous with the base exteriorly, a short streak in the middle above and to the inside, and a longer streak in the middle below and to the outside, as well as the apex, brown or brownish-black; tibia and tarsus fuscous black. Middle legs: acetabula with the rim above, a streak from it above, and a spot on the outer side brownish-black; coxæ dirty ochreous, base and apex brownish-black; femora dirty testaceous with fuscous pubescence, outer side with a brownish-black streak from base to apex; tibia and tarsus fuscous black. Hind legs: somewhat similar in colour to the middle legs. Abdomen above black, hind margins of the segments yellowish testaceous or pale fulvous in the middle, the pale markings on the posterior segments becoming triangular in shape. Second genital segment fulvous with apex black. Connexivum fulvous yellow, front and hind margins more or less broadly blackish-brown. Under side of the body dirty ochreous, with a slender fuscous streak on each

side before the middle legs, and a brownish spot on the mesosternum behind the front legs.

General form similar to that of *lituratus*. Spine-like hairs of the antennæ absent or broken off.

*Middle legs*: femur longer than the tibia and tarsus together; tibia about one-fifth shorter than the femur; tarsus (Pl. II. fig. 5, *m.t.*) less than half the length of the tibia, second joint about one-sixth the length of the first.

*Hind legs*: femur subequal in length to the middle femur, about one-fifth longer than the tibia and tarsus together; tibia more than four times the length of the tarsus; tarsus joints (Pl. II. fig. 5, *h.t.*) subequal, second cleft about the middle.

*Abdomen and genital segments* as in *lituratus*, but the genital segment below (♀), has not the notch in the sides (Pl. II. fig. 5 ♀ *ab. b.*).

### 3. *Halobatodes compar*, n. sp. (Pl. II. fig. 6).

Oblong oval, widest behind the middle. Dull black with yellowish testaceous lines and spots. Under side of body dull black. Front femora of male without a tubercle near the centre and no notch near the apex.

♂. Length 6.5, breadth 2.5, middle femur 7, hind femur 7 mm.

♀. Length 6, breadth 3, middle femur 7, hind femur 7.5 mm.

*Habitat*.—India (*Professor Westwood's Collection*).

♂. Oblong oval, widest behind the middle. Dull black with sparse greyish pubescence and dirty yellow-testaceous markings, as follows:—The head (except a large oblong spot on the vertex, a spot at the apex of the face, apex of the antenniferous tubercles, some streaks and spots on the rostrum, and the gula, which are dull black or brownish-black). The anterior angles, a large semicircular mark on each side, and most of the perpendicular sides of the pronotum. Mesonotum with two short longitudinal parallel lines, the posterior end of each of which joins a comma-shaped mark extending forwards on each side of the disk; a semicircular mark on each side posteriorly; a small triangular mark at each hinder angle; a wavy line along the sides; a streak above and another below on the acetabula of the hind legs. Sternum with a longitudinal line on each side, joined about the middle by a short transverse line to an irregular spot on each side of the middle of the disk; and a spot on the inferior margin of the middle acetabula, sometimes joined to the wavy line along the sides. The sides and hind margin broadly of the first genital segment above; and the hind margin of the first and the whole of the second and third below. Base of the antennæ (except at the very extreme base, which is shining piceous). Front legs: most of the under side of the acetabula except a large square spot, coxæ, trochanters, femora at base below, and a streak above reaching from the base to

near the apex, and with less distinctly a streak below reaching nearly to the apex, and a short streak on the posterior side near the apex. Middle legs: coxæ except some spots at the apex, trochanters except a brownish spot in the middle and a long streak on each side of the femora. Hind legs: similar to the middle legs but duskier in colour, and base and inner side of coxæ sometimes brownish.

General colour of legs and of abdomen below dull fuscous brown. Rostrum with last joint shining black. Antennæ with blackish hairs.

*Antennæ* (Pl. II. fig. 6, *a.*) slender, first joint subequal in length to the other three together; second joint about half the length of the first; third joint rather shorter than the second; fourth about three-fourths the length of the third.

*Front legs* (Pl. II. fig. 6, *f. l.*): femur not very thick, thickest about the middle, slightly curved; tibia rather shorter than femur, hind margin with brownish hairs; tarsus about half the length of tibia; second joint cleft about one-fourth the length from the apex.

*Middle legs*: femur shorter than the tibia and tarsus together; tibia about four-fifths the length of the femur; tarsus half the length of the tibia, first joint about six times longer than the second.

*Hind legs*: femur about one-fifth longer than the tibia and tarsus together, as long as the middle femur; tarsus less than one-sixth the length of the tibia, second joint cleft beyond the middle.

*Genital segments* (Pl. II. fig. 6 ♂ *ab. a.*, and 6 ♂ *ab. b.*): first above like the preceding abdominal segment, but twice as long; below as long as three of the abdominal ventral segments, hind margin concave. Second above nearly square, but a little wider posteriorly, convex, the hind margin fringed with long coarse hairs, especially towards the sides; below rather longer than the first below, the sides sloping obliquely backwards. Third above, a slightly convex tubercle, nearly embraced by the second, and bearing on each side of the base an erect, stout, recurved tooth; below a very convex oval plate, slightly raised in the middle line posteriorly, embracing the third above, margins fringed with long coarse hairs.

♀. Similar to the male, but colours rather brighter and markings more distinct. Front femora with the markings much more distinct. Abdomen with the hind margins of the ventral segments, except the first and the genital segments, yellowish ochreous. Antennæ and front legs more slender. Genital segments too much distorted in the only specimen to permit of the structure being made out clearly.

#### 4. *Halobatodes* (?) *stâli*, Dohrn.

*Halobates stâli*, Dohrn, Stett. Ent. Zeit., vol. xxi. p. 408, No. 103, 1860.

Dull black above, with yellow testaceous lines and spots; yellow testaceous below.

Length, 7 mm.

*Habitat*.—Ceylon.

I have not seen this species, though Dr. C. A. Dohrn kindly looked for the type in the collection of his son, Dr. Anton Dohrn (the well-known director of the zoological station at Naples), with a view of sending it to me. From the description it appears to belong to this genus, and to be closely allied to *Halobatodes compar*, from which the different colour of the under side of the body distinguishes it.

The following description is compiled from the original description, which will be found in the introductory part of this paper.

Opaque black above, with the following yellowish testaceous markings:—The head (except a large black central spot, and three smaller ones in front which are black). Thorax: in front two semicircular spots; behind, in the middle two parallel longitudinal spots, one on each side, shaped like a comma, another on each side transverse and semicircular, a third smaller spot on each side at the apex of the disk; more posteriorly one transverse, two longitudinal and three smaller apical spots. Front coxæ except a black spot above, and femora except three more or less broad black lines. Sides and body below yellow testaceous, the sides with longitudinal black streaks. Antennæ, middle and hind legs, and front tibiæ blackish. Rostrum yellowish testaceous, apex black. Eyes fuscous fulvous, with black spots.



### III. LIFE HISTORY AND HABITS.

---

#### METAMORPHOSES.

##### HALOBATES.

*The Egg.*—The only account that has been given of the egg of *Halobates* is by M. Léon Fairmaire, whose note on the subject is reproduced in the part of this memoir relating to the literature of the subject. I am able to add to our scanty knowledge, by describing the egg of *Halobates wüllerstorffi*, of which there is before me one of about twenty-five found (in a Challenger specimen of *wüllerstorffi*) by Mr. John Campbell, the optician to whom I am indebted for the preparation of the microscopic specimens which I have used in examining the minuter anatomical structure of these insects.

The egg is very large in comparison with the size of the animal. Consequently the small abdomen is not sufficiently spacious to contain even so few as twenty-five or thirty, and part of the cavity of the thorax is employed to hold them. The egg of *wüllerstorffi* (Pl. III. fig. 30) is long oval in outline, measuring 1.2 mm. long by .8 mm. broad, and the integuments do not show any particular markings or structure. The contents were rather coarse amorphous particles of coagulated albumen. The eggs found by M. Fairmaire are described as oblong in shape, and the species furnishing them were *sericeus* or *flaviventris*,—whether rightly determined or not, it is now impossible to say, as M. Fairmaire informs me that he gave away the specimens long ago.

No observations have been made as to when and where the eggs are deposited. The statement<sup>1</sup> that the female carries them about, attached to the abdomen, after they have been extruded, Professor Moseley informs me is a mistake.

*The Larva and Pupa.*—These two stages will be considered together, for in this as in other ametabolous groups of insects it is not easy to say where the one ends and the other begins, the more especially as we do not yet know how many times the young *Halobates* changes its skin.

While resembling in general form the adult animal, the larva has several important structural differences.

<sup>1</sup> Moseley, Notes by a Naturalist on the Challenger, p. 572.

The integuments are leathery, with isolated plates of chitin, of which the following are the principal :—A large central triangular plate on the head (the apex of the triangle being posterior), with a rather ill-defined long narrow plate on each side, leading from the back of the head to the antennæ; the margin of the orbits; two transversely oval plates on the pronotum; two large longitudinal oval plates on the mesonotum; two transverse reniform plates on the metanotum; a rather ill-defined narrow transverse plate on each side of the mesial line of each abdominal dorsal segment (Pl. III. fig. 29). In the abdomen the chitinization of each segment begins at the front margin and spreads backwards.

In dried specimens the number of abdominal segments cannot be made out from the shrinking of the integuments, but in two microscopical specimens ten rings can be distinguished behind the reniform plates of the metanotum, while in a third example nine rings only can be made out. This difference in the number may possibly be due to sex, and would seem to indicate that the male has, as its structure suggests, really four genital segments. The podical plates which terminate the body of the adult are present in the larva, but no trace can be found of the peculiar lozenge-shaped plate which precedes them in the adult male. One specimen, which from the rest of its structure must be regarded as not yet having undergone its final moult, presents all the external genital characteristics of the adult female.

The antennæ are stouter than in the adult and proportionately shorter. The jointlet between the second and third joints is rudimentary, and that between the third and fourth joints is not visible.

The peculiar tubercles which we have considered to be possibly ocelli are not visible or are more or less rudimentary, according to the age.

In like manner the dilatation of the apex of the front tibia is more or less undeveloped according to the age.

The front tarsus (Pl. I. fig. 1, *f.t.a*) has only one joint, which is cleft and furnished with claws beyond the middle. The other legs are relatively shorter and stouter than in the adult.

The coloration of the larva is somewhat similar to that of the adult, but the leathery portion of the integuments is often brown or reddish-brown.

#### HALOBATODES.

No observations of the metamorphoses have been made.

## HABITS.

## HALOBATES.

Except for the sake of calling attention to the necessity of observations, it is almost unnecessary to devote any space to this part of the subject, so little is known about it. The little that has been recorded about individual species has been noticed under each.

Mr. Murray writes to me as follows :—

“I have looked through my Challenger journals carefully for notes about *Halobates*, and find that I have noted its occurrence in the Atlantic 21 times between the latitudes 35° N. and 20° S., and 38 times in the Pacific between lats. 37° N. and 23° S. It would thus seem that these insects are confined to the warmer waters of the ocean, as we have no note of their occurrence north or south of these latitudes during our cruise.

“While the Challenger was engaged in dredging in the open ocean, a boat was lowered for the use of the naturalists whenever the weather permitted, and when away on such occasions *Halobates* was frequently observed. When the boat during calm weather was rowed near a dead *Porpita*, *Physalia*, *Salpa*, or fragment of some other creature floating on the surface, three or four *Halobates* would occasionally be observed to start out from it, and skim away over the surface in different directions. At first I thought that the insects were merely resting on the floating objects, but latterly I came to believe that they were feeding on them.

“The majority of the specimens taken by the tow-net were dead when brought on board, but we frequently took them alive, and observed them skimming over the surface of the water in our globes.

“We captured them both during the day and during the night; but most frequently when the ship was steaming during a calm, and the tow-net was kept dipping at the surface of the water. When the net was dragged beneath the surface, we did not, of course, expect to capture creatures scudding about on the surface; and nine-tenths of our tow-net observations were made by sinking the net beneath the surface. Hence on these occasions no specimens of *Halobates* were captured.

“On one occasion only have I observed *Halobates* dive. This was on 31st March 1875, on the passage from New Guinea to Japan, when a specimen having been captured alive, was seen to dive in the globe. Our assistant, Mr. Pearcey, says he remembers the circumstance distinctly.”

As a corroboration of this observation of the diving powers of *Halobates*, the following note<sup>1</sup> by Mr. J. J. Walker, of H.M.S. “Kingfisher,” may be quoted :—“I saw a good many specimens of the oceanic bug, *Halobates*, sp. ? on November 26, about 400 miles from the nearest land (on the voyage between San Francisco and Callao), and caught a few for Dr. Buchanan White. They are curious little ivory-legged fellows, resembling our

<sup>1</sup> *Entomologist's Monthly Magazine*, vol. xix. p. 278, May 1883.

familiar "*Gerris*" in structure and habits, and they skip about in the net when caught in just the same manner. They are apterous, and covered with silky bluish-white down, which carries down a supply of air to serve them when they dive beneath the surface, which they do very readily on the approach of the net. They are only seen when the sea is perfectly calm. I tried to keep two or three in a large bottle of sea-water, but they very soon died."

That all the species do not avail themselves frequently of this power of diving (if indeed they possess it) seems evident from the fact that it was only on one occasion that Mr. Murray had an opportunity of seeing it, and that Dr. Hay, who at my request observed the habits of *Halobates hayanus*, and kept specimens in captivity, never saw them dive.

From these notes it would seem that the habits of *Halobates* are probably much the same as those of the allied genera so frequently seen on the surface of fresh water in this and other countries, which, like *Halobates*, may often be seen congregated round any small recently dead animal (such as a fly) floating on the surface. The attraction is of course the juices of the animal, which they obtain by first piercing its integuments with the aid of their mandibles, and then sucking the fluid by means of the maxillæ.<sup>1</sup>

Some of the species occur close to the shore, but others are found in mid-ocean many hundred miles from land. In both situations they are gregarious to a greater or less extent. Their mode of progression is probably the same as that of the more closely allied fresh-water genera, which by means chiefly of the long middle and hind legs run rapidly (skim or scud) on the surface of the water, or when alarmed, progress by long jumps. These fresh-water species are said to be able to dive, but I do not think that this can be a common habit, for I have never seen it done by any of the thousands of specimens that have come under my observation. Some of the fresh-water species (*Gerris*) are said to be able to swim,<sup>2</sup> but this seems open to question. On the other hand, the long fringe on the middle tibia and tarsus of *Halobates* seems to be intended for something more than merely to support the animal on the surface. This supposition is strengthened by the fact that it is the middle and *undermost* legs that are provided with the fringe. It may be that the use of the fringe is not wholly, nor even mainly, for swimming, but for enabling its possessor to resist the action of the wind, by taking hold of the water, which it would do by submerging these legs. The fringe is often seven or eight times longer than the breadth of the tarsus, and the hairs which compose it are fine and flexible. At their base is a shorter fringe of stouter hairs, curved at the apex. It is possible that the animal can exercise some control over the position of the fringe, keeping it adpressed to the limb, so as not to impede its progress, when scudding over the surface; or extending it at right angles to the limb when this is immersed. The shorter fringe

<sup>1</sup> They also catch and kill living insects.

<sup>2</sup> Kirby and Spence, Entomology, p. 479.



may be part of the mechanism employed.<sup>1</sup> Observations are however very desirable on these points.

The absence of elytra and wings seems to be constant in *Halobates*, and on this account some authors formerly thought that the known specimens had not reached the adult condition. M. Fairmaire's discovery of eggs proved that this theory was erroneous, but an examination of the genital segments would have shown the same. The absence of wings and elytra is not unfrequent in many species of allied genera which live on the surface of fresh water;<sup>2</sup> and in their case the advantage, to the species, of the possession of these organs is intelligible, especially when they inhabit, as is often the case, small pools or marshes liable to be dried up in summer, or capable of supporting a limited number only of individuals. But to species which dwell on a practically inexhaustible surface as the sea the possession of wings would seem unnecessary, if not positively a disadvantage, as making their possessors and users liable to be carried off by the wind, and, if not blown to some inhospitable spot, separated at least from their companions, a probable disadvantage to gregarious species as the *Halobates* are.

Unless it has been derived from a fresh-water progenitor,—which is of course possible, but in view of its structure perhaps not very probable,—it seems likely that *Halobates* has never possessed wings. On the whole, there are good grounds for thinking that *Halobates*, if not the actual ancestor of its fresh-water allies, is much less differentiated from the common ancestor than they are. The small or *apparently* rudimentary condition of the abdomen which gives the adult *Halobates* so strong a resemblance to the immature *Gerris*, must not be lost sight of in this connection.

Amongst many points which require investigation in the life history, especial attention should be directed to the following:—

1. The food, and the manner in which it is seized and retained.
2. The manner of locomotion, and especially whether all the species have the power of diving beneath the water. Experiments may also be made as to the effect of compulsory submersion. As several writers have mentioned that specimens obtained by the tow-net have always been dead, it is probable that submersion means, in some cases, death by drowning.
3. What enemies they have; if they are eaten by any other animals; and what means of defence they have.
4. The use of the several peculiar organs or structures, such as the ocelli-like tubercles of the head; the perforated tubercle at the base of the ventral surface of the abdomen; the ribbon-like process connected with the claws of the tarsi,

<sup>1</sup> Though I am not yet quite certain, I think that in the species whose usual locality is the open sea the long fringe is longer than in those which dwell near the shore. The material at hand is not sufficient to clear up this point. If it be the case, the reason for it seems obvious.

<sup>2</sup> It is to be noted that this absence of wings is not necessarily due to an aquatic life, for most, if not all, of the *Hydrocorisa* have well-developed wings, which they not unfrequently use for aerial flight.

and the long curved hairs near the tips of the tarsi. It is probable that the latter are organs of touch, and intended to warn the animal of the approach of any enemy, as from their situation at the outer side of the extremities of the legs, it seems likely that any object approaching their possessor would come in contact with them first, and thus give notice of its approach. The curved tips of the hairs are perhaps to preserve them from being so readily broken as if they were straight.

#### HALOBATODES.

Of the habits of *Halobatodes* nothing has been recorded. Whether all the species inhabit the sea is uncertain. In fact it is not improbable that three of them are fresh-water species, and it is only because Frauenfeld has stated that he found one in the Chinese Seas that the genus has been included in this monograph, where, however, it deserves a place on account of the close resemblance in structure to *Halobates*.

## IV. GEOGRAPHICAL DISTRIBUTION.

---

Though the details of the distribution have already been given under each species, it is desirable that a few lines should be devoted to a consideration of (1) the distribution of the genus, and of the relations of the species, so far as regards their distribution, to each other; and (2) the factors that have caused, or at least aided, in bringing about the distribution.

### HALOBATES.

*Wüllerstorffi* is the most widely diffused species. It is pre-eminently *the* species of the North Atlantic, and occurs also in the South Atlantic, Indian, and West Pacific Oceans.

*Micans* is reported from the Atlantic, Indian, and Pacific Oceans, but seems to be very rare, and it is possible that some confusion exists in the records, and that *wüllerstorffi* has in some cases been confounded with *micans*.

*Sericeus* is a species that seems very abundantly represented by individuals, but it is almost confined to the Pacific, especially the North Pacific, of which it is pre-eminently *the* species. It has been recorded as occurring near the Cape and near Madagascar, but this is possibly an error of determination. I have before me two specimens (from the Challenger) from the North Atlantic. I cannot think that there is a mistake about the locality of these, but still, corroboration is very desirable.

*Flaviventris* is a rare species. I have seen specimens from near St. Helena, and from near Ceylon, and it has also been reported from near Madagascar.

All the remaining species are, so far as we yet know, very limited in their distribution.

*Streatfieldanus* has only once been taken in the South Atlantic; *hayanus* occurs at Aden; *frauenfeldanus* at the Nicobars; *proavus* near Gilolo; *princeps* in the Celebes Sea; and *germanus* and *sobrinus* in one or two localities in the Pacific.

To sum up, five species occur in the Atlantic, but one only is (so far as we know) restricted to that ocean, though the headquarters of another appear to be there.

Six species, of which two are peculiar, occur in the Indian Ocean, west of long. 100° E., while to the east of long. 100° E., and chiefly in the West Pacific, eight species occur, of which four are restricted to that region. But if we take the Indian Ocean and West Pacific together, we find that nine out of the eleven known species occur there, and five nowhere else. It would seem, therefore, that the region between the eastern part of the Indian Ocean and the West Pacific is the metropolis of the genus, and it does not seem to

demand too much from the imagination if we suppose that the genus originated there, and has spread thence to other parts of the world.

So far as some of the species are concerned, this seems almost certain. The two species *proavus* and *hayanus* are, while distinct enough, extremely closely allied and very similar in general appearance. The first occurs near Gilolo, the second in the Red Sea. Now Professor Semper<sup>1</sup> has pointed out the close alliance between the mollusca, crustacea, fishes, &c., of the Red Sea and Indian Ocean and those of the Philippines and Western Pacific, and has suggested that this alliance is due to the currents. He also states that a strong superficial current enters the Red Sea, and, while taking many species in, prevents the return of those which dwell on or near the surface. From this it seems not improbable that *hayanus* has been developed from emigrant individuals of *proavus*.

So far as general appearance and coloration go, two other species—*flaviventris* and *frauenfeldanus*—also resemble *proavus*, but structurally they present far greater differences, and indeed if *frauenfeldanus*, which I have not seen, be correctly described,<sup>2</sup> it would seem almost to deserve generic separation. *Frauenfeldanus* occurs at the Nicobar Islands, *flaviventris* near Ceylon, Madagascar, and St. Helena, and it does not seem impossible that they have in *proavus* their common ancestor, or at least have had with that species and *hayanus* a progenitor less remote than the common ancestor of the genus.

*Wüllerstorffi*, *micans*, and *princeps* are three other species somewhat closely allied. The headquarters of *wüllerstorffi* certainly appear to be the Atlantic, but notwithstanding this it probably came originally from the Western Pacific, for by the arrangement of ocean currents it seems scarcely possible that it should have spread in the opposite direction.

In like manner *sericeus*, if it occurs elsewhere than the Pacific, has probably been carried thence by the currents.

Of the distribution of the remaining species we know too little to make it worth discussion. To conclude, it seems probable that the genus originated in the region of the West Pacific, and that the species, or their ancestral forms, have been distributed by the ocean currents.

#### HALOBATODES.

*Halobatodes lituratus* is reported as occurring in the Chinese Sea, between Manilla and Hong Kong. The locality of the closely allied *histris* is "Japan," but whether it is marine or fresh-water is not stated. *Compar* is an Indian species, and *stali* comes from Ceylon.

This distribution is interesting, when it is remembered that the metropolis of the species of *Halobates* is the region between the Indian Ocean and Western Pacific, and that *Halobatodes* has probably been derived from *Halobates*.

<sup>1</sup> The Natural Conditions of Existence, p. 279, 1881.

<sup>2</sup> See however the description, *antéa*, p. 57.



## APPENDIX.

---

### *The Ventral Tubercle.*

Since the description of the "ventral tubercle" was printed (pp. 31 and 32) it has occurred to me that this peculiar structure may possibly be the orifice of the canals leading from the odoriferous glands. These orifices are usually situated on each side of the metasternum near the posterior coxæ. If this be the case, it is possible that what we have considered to be the first abdominal ventral segment may be the metasternum, though this seems very improbable.

### *Excluded Species.*

1. *Halobates albinervus*, Am. et Serv. (Hist. Nat. des Insectes, Hémiptères, p. 412, 1843), is a fresh-water Brazilian species, for which Mayr (Verh. zool. bot. Ges., 1865, p. 445; and Reise d. Freg. Novara, Zool., Band ii., Abth. 1, p. 177, 1866) founded the genus *Brachymetra*. It is to be noted that some authors write the specific name *albinervis*, but the original is *albinervus*.
2. *Halobates pictus*, Germ. (Herrich-Schäffer, Die wanzenart. Insecten, Band viii. p. 108, 1848), is another fresh-water North American species, which we take as the type of the new genus *Stephania*.<sup>1</sup> A winged form of this is said to have

<sup>1</sup> *Stephania*, n. g. Body oval, moderately pubescent. Head (with eyes) subtriangular. Antennæ four-jointed, with two intermediate jointlets. Eyes large, situated at the back of the head, and resting partly on the pronotum. Ocelli absent. Prothorax transverse, broader than long, distinct from the mesothorax. Mesothorax and metathorax together cylindrical, subcoalesced, the suture between them distinct on the upper surface. Mesonotum with a narrow free process (scutellar), posteriorly overlapping the base of the abdomen. Metasternum not visible. Elytra and wings! Front legs short, rather slender: tibia without an apical process; tarsus two-jointed, the second joint excavated beyond the middle, but without a process, furnished with claws. Middle and hind legs rather long and slender, inserted at the posterior end of the thorax; the hind legs inserted above the middle legs. Middle legs without a fringe of long hairs: tarsus! Hind legs with one-jointed tarsus clawed before the tip. Abdomen short, sides furnished with a conspicuous connexivum; apex of male abdomen without a conspicuous rhomboidal appendage.

Type.—*Halobates pictus*, Germ. *Halobates platensis*, Berg., also probably belongs to this genus, but I have seen larvae only, and they have not the scutellar process of the mesonotum, which serves at once to separate this genus from *Halobates*. I have also seen but one specimen of *Stephania picta*, and that a female, and not quite perfect, so that the generic diagnosis is not so complete as it might be. *Metrocoris*, Mayr (with a single species, *Metrocoris brevis*, Mayr, found in Ceylon and India), is in many ways closely allied to *Stephania* and *Halobates*. So also is *Platygeris*, mihi (with a single species—*Platygeris depressa*, mihi—from Mexico).

been found, but very rarely. Though Germar is cited as the author of this species, it was described by Herrich-Schäffer.

3. *Halobates platensis*, Berg. (Hemiptera Argentina, p. 183, No. 220, 1879), is a fresh-water species from the Argentine Republic, probably congeneric with *Stephania picta*.
4. *Halobates* (?) *orientalis*, Distant (Trans. Ent. Soc. Lond., p. 126, 1879), is an Indian fresh-water species, which the author now admits (Scientific Results of the Second Yarkand Expedition, Rhynchota, p. 13, No. 38, 1879) does not belong to *Halobates* though allied thereto.

I may mention that Mr. Murray has shown me drawings and description (made by Sir J. D. Hooker) of a *Halobates* taken during Sir James Ross's Antarctic Voyage. The species figured appears to belong to an undescribed form, but as Sir J. D. Hooker tells me that the specimens have unfortunately been lost, nothing more can be said about it.

---

*Halobates princeps* ♂.

At the moment of going to press, I have received, through the kindness of Professor Bogdanow of the Moscow Museum, the loan of two specimens of the species referred to in Professor Semper's note (p. 22). They seem to be males of my *Halobates princeps*. The third genital segment above is comparatively narrow, six-sided, and with the usually prominent lateral angles truncate, so that the segment is parallel-sided in the middle.

# INDEX.

The figures in dark type indicate the page where the Genus or Species is fully described.

- Abdomen of the female of *Halobates*, 32.  
 „ „ *Halobatodes*, 61.  
 „ male of *Halobates*, 31.  
 „ „ *Halobatodes*, 60.  
 Abnormal antennæ in *Halobates germanus*, 51.  
 Acetabulum of *Halobates*, anterior, 29.  
 „ *Halobatodes*, anterior, 61.  
 Amyot, C. J. B., 9.  
 Anatomy and description of genera and species, 23.  
 Ancestry of *Halobates*, 75, 78.  
 „ *Halobatodes*, 78.  
 Antennæ of *Halobates*, 25.  
 „ *Halobatodes*, 59.  
 Berendt, G. C., 14.  
 Bibliography, 1.  
 Blanchard, E., 8.  
*Brachymetra*, 10.  
 Burmeister, H., 5.  
 Collingwood, Cuthbert, 42.  
 Description of the species of *Halobates*, 39.  
 „ „ *Halobatodes*, 63.  
 Distribution geographical, 77.  
 Distribution of *Halobates*, causes of, 78.  
 Diving powers of *Halobates*, 74.  
 Dohrn, A., 15.  
 Egg of *Halobates*, 13, 71.  
 Eschscholtz, J. Friedrich, 2.  
 Excluded species, 79.  
 Eyes of *Halobates*, 25.  
 Fairmaire, L., 12.  
 Food of *Halobates*, probable, 73.  
 Fossil *Halobates*, supposed, 14.  
 Frauenfeld, G. von, 16.  
 Fringe on middle tarsus, possible use of, 74.  
 Genera, key to, 23.  
 Genital segments of the female of *Halobates*, 34, 72.  
 „ „ „ *Halobatodes*, 61.  
 „ „ male of *Halobates*, 32, 72.  
 „ „ „ *Halobatodes*, 61.  
 Geographical Distribution, 77.  
 Giglioli, E. H., 19.  
 Habits, life history and, 71.  
 Habits of *Halobates*, 73.  
 Hairs on front tibia in *Halobates*, peculiar patch, 35.  
*Halobates*, 2, 4, 5, 8, 9, 11, 23, 71, 73, 77.  
*Halobates*, characters of the genus, 23.  
 „ details of structure of, 24.  
*Halobates albinervis*, A. and S., 10, 79.  
*albinervis*, 16,  
*cyanipes*, 18.  
*flaviventris*, Esch., 5, 6, 12, 13, 18, 55, 71,  
 77 (Pl. II. fig. 2).  
*flaviventris*, Frauenf., 4, 16, 18, 57.  
*frauenfeldanus*, 57, 77 (Pl. II. fig. 3).  
*germanus*, 50, 77 (Pl. I. fig. 6).  
*hayanus*, B. W., 28, 52, 77 (Pl. I. fig. 8 ;  
 Pl. III. fig. 29).  
*lituratus*, Stål, 13, 14, 15, 16, 23, 64.  
*micans*, Esch., 3, 5, 8, 12, 16, 17, 43, 77  
 (Pl. I. fig. 2).  
*orientalis*, Dist., 79.  
*pictus*, Germ., 12, 15, 23, 79.  
*platensis*, Berg., 79.  
*princeps*, 44, 77 (Pl. I. fig. 3).  
*proanus*, 54, 77 (Pl. II. fig. 1).  
*sericeus*, Esch., 3, 6, 9, 10, 11, 13, 25,  
 27, 28, 30, 34, 35, 36, 37, 38, 47, 71,  
 77 (Pl. I. fig. 7 ; Pl. III. figs. 1, 4, 5, 5a,  
 6, 6a, 7, 10, 11, 12, 15, 17, 20, 24,  
 26).  
*sobrinus*, 46, 77 (Pl. I. fig. 5).  
*stål*, Dohrn, 15, 69.  
*streetfieldana*, Templ., 6, 45.  
*streetfieldanus*, Templ., 45, 77 (Pl. I.  
 fig. 4).  
*wüllerstorffi*, Frauenf., 16, 17, 25, 27, 30,  
 34, 35, 36, 37, 38, 40, 71, 77  
 (Pl. I. fig. 1 : Pl. III. figs. 2, 3, 8, 9,  
 13, 14, 16, 18, 19, 21, 22, 23, 25, 27,  
 28, 30).  
*Halobates wüllerstorffi*, egg of, 71.  
*Halobatodes*, 23, 58, 72, 75.

- Halobatodes*, characters of the genus, 58.  
*Halobatodes*, details of structure of, 59.  
     „ distribution of, 78.  
     „ habits of, 75.  
     „ metamorphoses of, 72.  
*Halobatodes compar*, n. sp., 68, 78 (Pl. II. fig. 6).  
     *histrion*, n. sp., 66, 78 (Pl. II. fig. 5).  
     *lituratus*, Stål, 59, 64, 78 (Pl. II. fig. 4).  
     *stæli*, Dohrn, 69, 78.  
 Hay, G., on habits of *Halobates*, 74.  
 Head of *Halobates*, structure of, 24.  
     „ *Halobatodes*, structure of, 59.  
 Herrich-Schäffer, G. A. W., 11.  
 History and Bibliography, 1.  
 Hooker, Sir J. D., 79.  
*Hyalometra abbreviata*, Fab., 8.  
 Key to genera, 23.  
     „ species of *Halobates*, 39.  
     „ „ *Halobatodes*, 63.  
 Laporte, F. L. de, 4.  
 Larva of *Halobates*, 18, 71.  
 Legs of *Halobates*, front, 34.  
     „ „ hind, 38.  
     „ „ middle, 36.  
     „ *Halobatodes*, front, 61.  
     „ „ hind, 62.  
     „ „ middle, 62.  
 Life history and habits, 71.  
 Mandibles of *Halobates*, 27.  
 Maxillæ of *Halobates*, 27.  
 Mayr, Dr. G., 15.  
 Metamorphoses of *Halobates*, 71.  
*Metrocoris*, 79.  
 Metropolis of *Halobates*, 77.  
 McLachlan, R., 21.  
 Moseley, Professor, 71.  
 Murray, J., on distribution of *Halobates*, 73.  
     „ habits of *Halobates*, 73.  
 Ocellus-like tubercles of *Halobates*, 25, 72.  
 Odoriferous glands of *Halobates*, 79.  
     „ „ *Platygerris*, 79.  
 Pleuron of *Halobates*, thoracic, 30.  
 Progression of *Halobates*, manner of, 74.  
 Pupa of *Halobates*, 71.  
 Respiratory system, 38.  
 Rostrum of *Halobates*, 26.  
     „ *Halobatodes*, 59.  
 Semper, K., 21.  
 Serville, A., 9.  
 Species of *Halobates*, number of, 39.  
     „ *Halobatodes*, number of, 63.  
 Spinola, Maximilien, 8.  
 Spiracles, 30, 38.  
     „ Metathoracic, 30, 63.  
 Stål, C., 13, 14.  
*Stephania*, 23, 79.  
 Tarsus of *Halobates*, Frauenfeld on structure of front, 16.  
 Tarsus of larva of *Halobates*, structure of front, 72.  
 Tarsus, possible use of fringe on middle, 74.  
 Templeton, R., 6.  
 Thorax of *Halobates*, 28.  
     „ *Halobatodes*, 60.  
 Ventral tubercle of *Halobates*, 32, 79.  
     „ „ *Halobatodes*, 60.  
 Walker, J. J., on habits of *Halobates*, 74.



PLATE I.

# PLATE I.

Fig. 1.—*Halobates wüllerstorffi*, Frauent.

|                                      |                                                  |
|--------------------------------------|--------------------------------------------------|
| 1 ♂. Male, upper side.               | 1 g. Genital segments of the male from above.    |
| 1 a. Antenna.                        | 1 g. a. Genital segments of the male in profile. |
| 1 f.t. Front tarsus.                 | 1 ♀. Outline of the body of the female.          |
| 1 f.t. a. Front tarsus of the larva. |                                                  |
| 1 m.t. Middle tibia and tarsus.      |                                                  |

Fig. 2.—*Halobates micans*, Esch.

|                                                           |                                   |
|-----------------------------------------------------------|-----------------------------------|
| 2 ♀. Female, upper side (after Eschscholtz). <sup>1</sup> | 2 a. Antenna (after Frauentfeld). |
|-----------------------------------------------------------|-----------------------------------|

Fig. 3.—*Halobates princeps*, n. sp.

|                          |                                 |
|--------------------------|---------------------------------|
| 3 ♀. Female, upper side. | 3 f.t. Front tarsus.            |
| 3 a. Antenna.            | 3 m.t. Middle tibia and tarsus. |

Fig. 4.—*Halobates streatfieldanus*, Templ.

|                                            |                                     |
|--------------------------------------------|-------------------------------------|
| 4 ♀. Female, upper side (after Templeton). | 4 f.l. Front leg (after Templeton). |
| 4 a. Antenna                               | 4 f.t. Front tarsus.                |

Fig. 5.—*Halobates sobrinus*, n. sp.

|                            |                                               |
|----------------------------|-----------------------------------------------|
| 5 ♂. Male, upper side.     | 5 f.t. Front tarsus.                          |
| 5 ♀. Female, upper side.   | 5 m.t. Middle tibia and tarsus.               |
| 5 ♀ a. Female, under side. | 5 g. Genital segments of the male from above. |
| 5 a. Antenna.              |                                               |

Fig. 6.—*Halobates germanus*, n. sp.

|                          |                                               |
|--------------------------|-----------------------------------------------|
| 6 ♂. Male, upper side.   | 6 f.t. Front tarsus.                          |
| 6 ♂ a. Male, under side. | 6 m.t. Middle tibia and tarsus.               |
| 6 ♀. Female, upper side. | 6 g. Genital segments of the male from above. |
| 6 a. Antenna.            |                                               |

Fig. 7.—*Halobates sericeus*, Esch.

|                                          |                                               |
|------------------------------------------|-----------------------------------------------|
| 7 ♂. Male, upper side.                   | 7 f.t. Front tarsus.                          |
| 7 ♂ a. Male, under side.                 | 7 m.t. Middle tibia and tarsus.               |
| 7 ♀. Female, upper side.                 | 7 g. Genital segments of the male from above. |
| 7 ♀ ab.b. Female, under side of abdomen. |                                               |
| 7 a. Antenna.                            |                                               |

Fig. 8.—*Halobates hayanus*, n. sp.

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| 8 ♂. Male, upper side.                      | 8 a. Antenna.                                    |
| 8 ♂ a. Male, under side.                    | 8 a.c. Anterior acetabulum, coxa and trochanter. |
| 8 ♂ β. Male, outline of body.               | 8 f.t. Front tarsus.                             |
| 8 ♂ γ. Male, outline of body from the side. | 8 m.t. Middle tarsus.                            |
| 8 ♂ ab.b. Male, under side of abdomen.      | 8 g. Genital segments of the male from above.    |
| 8 ♀. Female, upper side.                    |                                                  |
| 8 ♀ a. Female, under side.                  |                                                  |

<sup>1</sup> The size has been reduced, and position of the legs a little altered. It is to be noted that the middle and hind legs are, as in Eschscholtz' other drawings of *Halobates*, out of proportion to the length of the body.

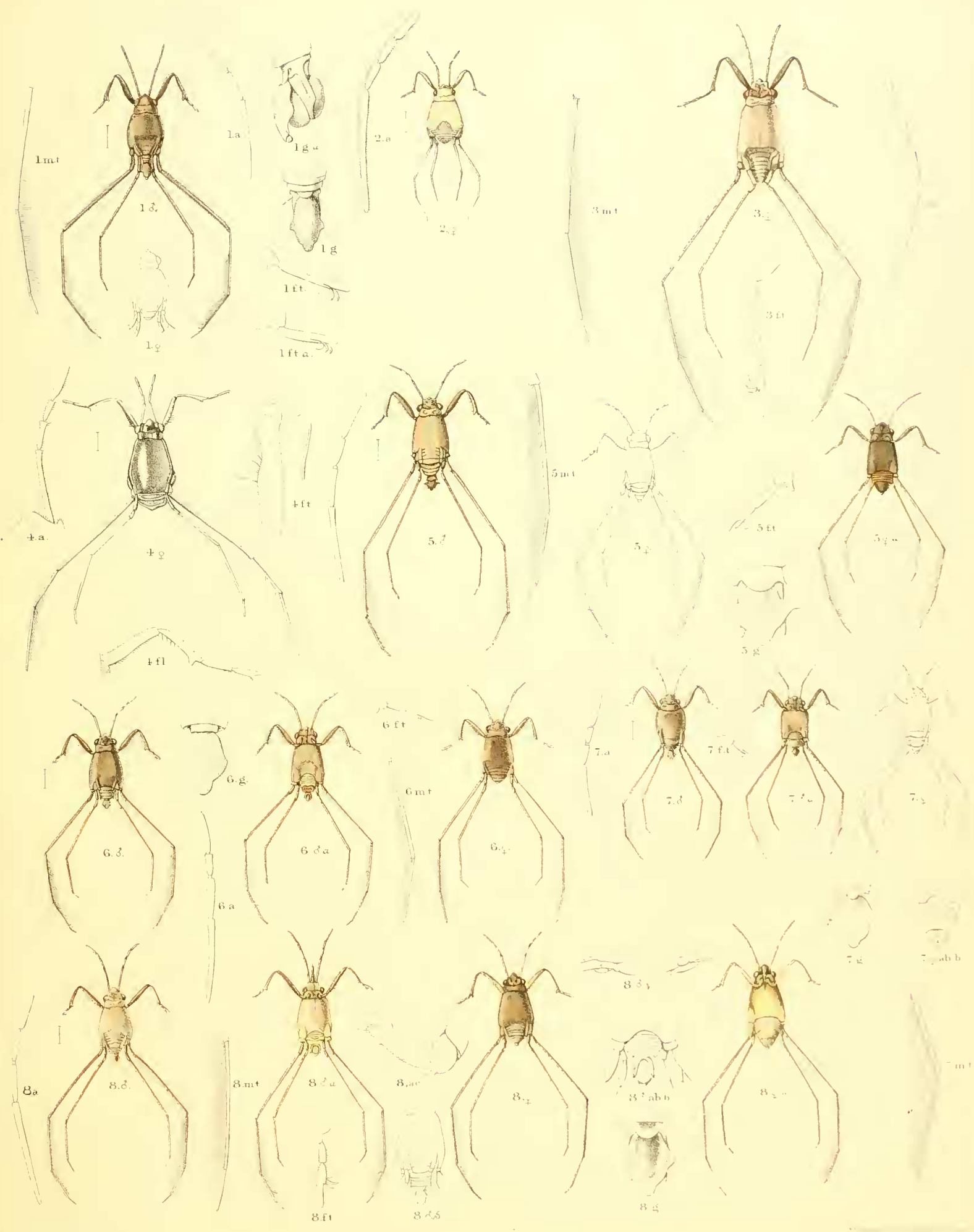






PLATE II.

## PLATE II.

Fig. 1.—*Halobates proavus*, n. sp.

|                                 |                                                      |
|---------------------------------|------------------------------------------------------|
| 1 ♂ . Male, upper side.         | 1 <i>m.t.</i> Middle tarsus.                         |
| 1 ♂ <i>a.</i> Male, under side. | 1 <i>g.</i> Genital segments of the male from above. |
| 1 <i>a.</i> Antenna.            |                                                      |
| 1 <i>f.t.</i> Front tarsus.     |                                                      |

Fig. 2.—*Halobates flaviventris*, Esch.

|                                 |                                                      |
|---------------------------------|------------------------------------------------------|
| 2 ♂ . Male, upper side.         | 2 <i>m.t.</i> Middle tibia and tarsus.               |
| 2 ♂ <i>a.</i> Male, under side. | 2 <i>g.</i> Genital segments of the male from above. |
| 2 <i>a.</i> Antenna.            |                                                      |
| 2 <i>f.t.</i> Front tarsus.     |                                                      |

Fig. 3.—*Halobates frauenfeldanus*, n. sp.

|                                              |                                         |
|----------------------------------------------|-----------------------------------------|
| 3 ♀ . Female, upper side (after Frauenfeld). | 3 <i>a.</i> Antenna (after Frauenfeld). |
|----------------------------------------------|-----------------------------------------|

Fig. 4.—*Halobatodes lituratus*, Stål.

|                                              |                                                |
|----------------------------------------------|------------------------------------------------|
| 4 ♂ . Male, upper side.                      | 4 ♀ <i>ab.a.</i> Upper side of female abdomen. |
| 4 ♂ <i>a.</i> Male, under side.              | 4 ♀ <i>ab.b.</i> Under side of female abdomen. |
| 4 ♂ <i>ab.a.</i> Upper side of male abdomen. | 4 ♀ <i>f.l.</i> Front leg of female.           |
| 4 ♂ <i>ab.b.</i> Under side of male abdomen. | 4 <i>a.</i> Antenna.                           |
| 4 ♂ <i>f.l.</i> Front leg of male.           |                                                |

Fig. 5.—*Halobatodes histrio*, n. sp.

|                                                |                                                          |
|------------------------------------------------|----------------------------------------------------------|
| 5 ♀ . Female, upper side.                      | 5 <i>a.c.</i> Anterior acetabulum, coxa, and trochanter. |
| 5 ♀ <i>a.</i> Female, under side.              | 5 <i>m.t.</i> Middle tarsus.                             |
| 5 ♀ <i>β.</i> Female, body from the side.      | 5 <i>h.t.</i> Hind tarsus.                               |
| 5 ♀ <i>ab.b.</i> Under side of female abdomen. |                                                          |
| 5 <i>a.</i> Antenna.                           |                                                          |

Fig. 6.—*Halobatodes compar*, n. sp.

|                                              |                                              |
|----------------------------------------------|----------------------------------------------|
| 6 ♂ . Male, upper side.                      | 6 ♂ <i>ab.b.</i> Under side of male abdomen. |
| 6 ♂ <i>a.</i> Male, under side.              | 6 <i>a.</i> Antenna.                         |
| 6 ♂ <i>ab.a.</i> Upper side of male abdomen. | 6 <i>f.l.</i> Front leg.                     |

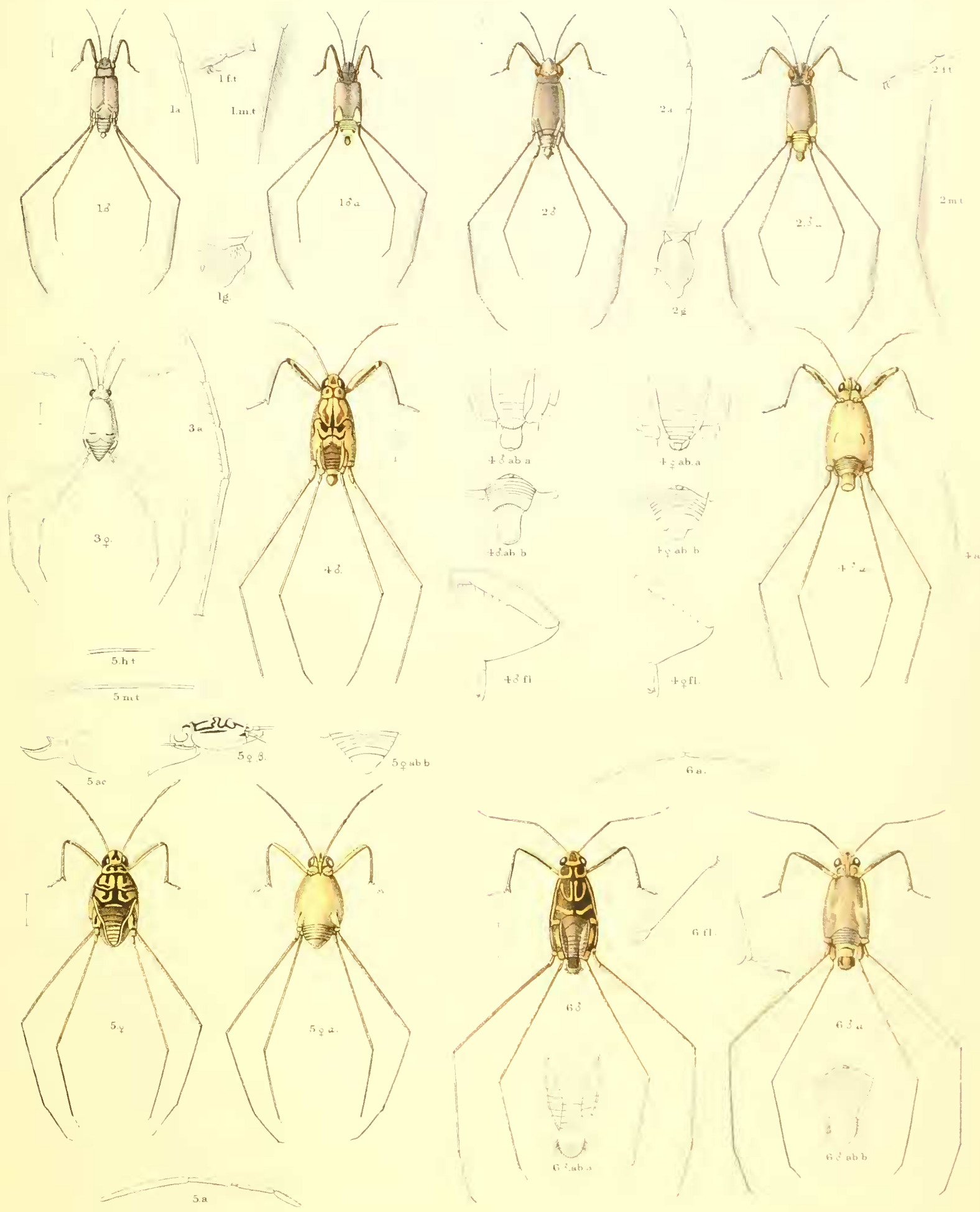






PLATE III.

### PLATE III.

(All the figures are more or less magnified.)

- Fig. 1.—Part of antenna of *Halobates sericeus*, showing the jointlets between the second and third, and third and fourth joints.
- Fig. 2.—Upper side of the last (4th) joint of rostrum of *Halobates wüllerstorffi*.
- Fig. 3.—Under side of the last (4th) joint of rostrum of *Halobates wüllerstorffi*.
- Fig. 4.—Apical part of a mandible of *Halobates sericeus*, showing the teeth.
- Fig. 5.—The conjoined maxillæ of *Halobates sericeus*, from about the middle of the rostrum, seen from above. *b, b*, the maxillæ, *a* the space between them.
- Fig. 5*a*.—Theoretical diagram of a transverse section of the maxillæ; same species and part as fig. 5.
- Fig. 6.—Apex of the conjoined maxillæ of *Halobates sericeus*.
- Fig. 6*a*.—Apex in profile of one maxilla of the same species.
- Fig. 7.—Outline of head of *Halobates sericeus*, showing the situation of the ocellus-like tubercles.
- Fig. 8.—One of the ocellus-like tubercles in *Halobates wüllerstorffi*, showing the smaller hair-tipped tubercle inside the rim.
- Fig. 9.—Apex of the front tibia of *Halobates wüllerstorffi*, ♂, showing the peculiar patch of hairs.
- Fig. 10.—Apex of the front tibia in *Halobates sericeus*, ♂, showing the peculiar patch of hairs.
- Fig. 11.—Some of the hairs from the peculiar patch on the front tibia of *Halobates sericeus*, ♂.
- Fig. 12.—Apex of the front tibia of *Halobates sericeus*, ♀.
- Fig. 13.—Front tarsus of *Halobates wüllerstorffi*.
- Fig. 14.—Claws of the front tarsus of *Halobates wüllerstorffi*.
- Fig. 15.—Middle leg of *Halobates sericeus*, *tr.* trochanter, *f.* femur, *ti.* tibia, *ta. 1* tarsus first joint, *ta. 2* tarsus second joint.
- Fig. 16.—Part of middle tibia and tarsus of *Halobates wüllerstorffi*. The letters have the same meaning as in fig. 15.
- Fig. 17.—Part of first joint of middle tarsus of *Halobates sericeus*, showing the short and long meaning fringes.
- Fig. 18.—Apex of the hind tarsus of *Halobates wüllerstorffi*.
- Fig. 19.—Apex of the hind tarsus of *Halobates wüllerstorffi*.
- Fig. 20.—Second and third genital segments of the male of *Halobates sericeus* denuded.
- Fig. 21.—Upper side of second genital segment of the male of *Halobates wüllerstorffi*.
- Fig. 22.—Under side of the second genital segment of the male of *Halobates wüllerstorffi*, showing asymmetry of the horns. (In the drawing the asymmetry is shown on the wrong side. It is the left horn which is twisted.)
- Fig. 23.—One of the "horns" of the second genital segment of the male of *Halobates wüllerstorffi*.
- Fig. 24.—One of the "horns" of the second genital segment of the male of *Halobates sericeus*.
- Fig. 25.—Upper side of the third genital segment above of the male of *Halobates wüllerstorffi* denuded.
- Fig. 26.—Under side of the third genital segment above of the male of *Halobates sericeus*.
- Fig. 27.—Inner side of the third genital segment below of the male of *Halobates wüllerstorffi*.
- Fig. 28.—Side-view of the "capsule" of the male of *Halobates wüllerstorffi*.
- Fig. 29.—Abdomen of the larva of *Halobates hayanus*, showing the chitinization.
- Fig. 30.—Egg of *Halobates wüllerstorffi*.

